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THE INVENTORS' INSTITUTE

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Chairman of the Council—**SIR ANTONIO BRADY.**

THE various efforts which have been made, and the numerous influences now at work to injure, if not to destroy, Patent Rights; the inefficiency of the many well intended, but ill considered, schemes of Patent Law Reform which have from time to time been suggested, and the tendency of which has generally been to prejudice the Inventor, without advantage to the Public; together with the proceedings so essentially involving the interests of inventors which have already taken place in Parliament, show the necessity of an immediate and active co-operation on the part of those interested in Inventions and in Patent Property, and that an Association for the Protection and Defence of Patent Rights is urgently needed. This Institute has, therefore, been established for the purpose of uniting and organizing the influence of Inventors, Patentees and others. Its objects are:—

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APPLICATIONS FOR LETTERS PATENT.

⁎ In this list (Com.) means Invention communicated from abroad.

Further information, as to the progress of these Patents by Notice to Proceed, Sealing, and Specifying, can be obtained at the Office, 21, Cockspur-street, Charing Cross

On December 29th.—4459 to 4465.—J. H. Brown. Manufacture of artificial skins from the refuse waste pieces of animal hides and skins, in combination with or without vegetable pulp and certain chemicals, to render the said skins more impervious to water than the generality of leather; these artificial skins are to represent vellum, parchment, and leather.—D. L. Davis. Machines or apparatus for cleaning and polishing boots and shoes.—J. S. Levett. Construction or combination of apparatus to be employed in instructing in the art of swimming, in bathing, in saving lives at sea, and for other analogous purposes.—J. Protheroe. Wicks (com.)—J. T. Kirkwood. Manufacture of iron and steel.—G. Haseltine. Slide valves of steam engines (com.) (Complete specification).—T. T. Lingard. Machine cutting tools, and holders for carrying the same.

On December 30th.—4466 to 4478.—G. Haseltine Motive-power engines to be worked by steam air, or other elastic fluid (com.) (Complete specification.)—J. Marshall and J. Lister. Furnaces for steam boilers, and apparatus connected therewith.—T. J. Hogg. Means of and apparatus for sanitarily ventilating houses, buildings, rooms, chimney flues, ships or vessels, sewers, external gas lamps, and other such like purposes.—J. Mackintire. Machinery or apparatus employed when casting metals under pressure.—W. Weems. Hydrostatic presses.—J. Briggs, R. Hudson, and H. Grimshaw. Ornamenting and transferring patterns to fabrics.—G. W. Rendel. Submarine torpedoes, and apparatus to be used in connection therewith.—P. Jensen. Copying pencil (com.)—J. Wharton and G. Yule. Machine or apparatus for forming hat bodies. (Complete specification.)—S. J. Neave. Conducting cores for submarine and other electric telegraph cables.—J. H. Johnson. Rotary puddling machines. (com.)—A. M. Clark. Preparation of black lead for polishing stoves and other uses (com.)—G. Haycraft. Metallic casks for containing gunpowder and other uses, and machinery for manufacturing the same.

On December 31st.—4479 to 4492.—H. Bradley and W. Bull. Check registering apparatus for issuing tickets, and for registering fares or amounts so received.—W. Martin. Portable closets or commodes for the collection of the solid matters of human excrements, and for the separation and deodorization of the liquids.—

W. Spence. Machinery or apparatus to be used in the manufacture of hats (com.) (Complete specification.)—R. Dick. Boots and shoes.—H. R. Stevenson and G. W. Hart. Manufacture of fuel.—H. Holland and G. Phillips. Combination of helical springs.—T. J. Smith. Apparatus for inking or blind stamping, dating or impressing papers, documents, and other articles (com.)—G. Haseltine. Manufacture of enamelled pipes, pipe couplings, and other articles or apparatus exposed to the action of gases or liquids (com.) (Complete specification.)—T. S. Truss. Arrangement of force pumps, and the combination and application of mechanical actions for working the same, to supply water or other fluids for the motive power of engines.—G. Taylor. Coffer shovels.—W. Anderson. Means for producing and sustaining pressure, applicable to the raising and the transference of loads.—W. Anderson. Centrifugal pumps.—A. M. Clark. Surgical instruments known as "litholycites (com.) (Complete specification.)—J. H. Johnson. Means of or appliances for controlling or curbing draught horses (com.)

On January 1st.—1 to 18.—J. G. Stormont. Call-bell and actions used in call and other bells.—H. A. Bonneville. Machines for carding, combing, and spinning wool and other fibrous materials in general (com.) (Complete specification.)—W. L. Wise. Machinery or apparatus for drilling, boring, or cutting rock or other hard substances (com.)—H. Wilcke. Propulsion of screw steam ships.—W. R. Lake. Kindling fires (com.)—E. Hunt. Musical instrument (com.)—C. Millbourn. Means of preventing and signalling accident to carriages of a railway train, and apparatus for that purpose.—M. Tildesley. Construction of door bolts and other fastenings.—W. S. Fish. Compound material applicable for packing stuffing boxes of engines, pumps, and other mechanism, for packing joints of pipes, boilers, tanks, cylinders, and valve chests, and others analogous thereto, also applicable for covering floors, roofs, and other surfaces.—W. R. Foster. Railway brake.—J. Bonner. Elastic web looms and other weaving machinery.—J. J. Perry and R. A. Jones. Means for lighting cigars and other articles, and for obtaining light for other purposes.—R. Beattie and R. Blair. Sewing machines.—W. Fenton, J. Fenton, and C. H. Newsome. Machinery or apparatus for carding, gilling, and roving worsted, silk, flax, cotton, and other fibres.—J. Waugh. Closing and opening bottles containing gaseous or effervescing liquids, and the means employed therefor.—B. Rhodes and T. B. Rhodes. Machinery for flocking woollen or other woven or felted fabrics.—I. Fielden. Steam engines.—G. T. Bousfield. Metallic fasteners for buttons, and the means for and the mode of attaching the same to wearing apparel (com.)

On January 2nd.—19 to 28.—J. Collier and J. Holding. Application to domestic "coppers" or other similar boilers, of an hydraulic circulator and distributor.—W. E. Gedge. Agricultural machine termed the "Extirpator-sower" (com.)—A. Sauvée. Self-acting regulator for twisting machines (com.)—P. Evans and H. Williams. Means of and apparatus for stoppering bottles.—J. Browning. Latches or fastenings for doors, casements, and shutters.—W. R. Miller. Pianos and similar musical instruments. (Complete specification.)—H. W. Stringfellow. Manufacture of drain pipes.—P. Jensen. Printing on and ornamenting tinned or other metallic plates (com.)—G. Haseltine. Apparatus for teaching in schools (com.) (Complete specification.) — A. M. Clark. Machinery for preparing cotton and other fibrous substances for spinning (com.)

On January 4th —29 to 42.—W. Poole. Construction of planes for cutting blind slates (com.)—J. Ellison. Method of and apparatus for self-acting fasteners for railway waggon or other doors.—T. Kendrick. Ornamentation of coffin furniture.—C. Catlow and T. Richmond. Looms for weaving.—A. Dudgeon. Distillation of spirituous and other liquors, and apparatus to be employed therefor.—W. Holland. Manufacture of parts of umbrellas and parasols, and machinery to be used in the manufacture of parts of umbrellas and parasols (partly com.)—M. B. Nairn. Machinery for preparing floor cloths for printing.—H. E. Lester, jun., and G. Hallett. Apparatus for releasing boats from ships ready for lowering same into the sea.—E. P. H. Vaughan. Press for the extraction of the liquid constituents of fruits and other vegetable matters (com.)—J. Scott. Preparation or dressing for stiffening or finishing textile fabrics and materials, which is also applicable to other purposes (com.)—J. Wavish. Apparatus for facilitating the proper combustion of fuel.—W. Kennedy and G. Acheson. Machinery for spinning flax and other fibrous materials.—J. Carver and G. Pigott. Bobbin net or twist lace machines.—W. R. Lake. Drawers (com.)

On January 5th.—43 to 51.—C. W. Siemens. Construction and working of furnaces for the production of iron, steel, and ferro-manganese, and processes connected therewith.—J. Green. Apparatus to be applied to fire grates for economizing fuel.—A. Bois. Guards or safety apparatus applicable to tramway cars and other vehicles.—A. Bonnefond. Meter, or apparatus for measuring water and other liquids.—J. H. Johnson. Machines for sharpening twist drills (com.)—W. R. Lake. Machinery for making horse-shoes (com.)—A. M. Clark. Mattresses and pillows for use on ship-board, whereby they may be converted into life preservers, life mattresses, and other life saving apparatus (com.)—G. F. Deacon. Apparatus for measuring the flow of water in pipes.—J. Turnock. Steam-engines, or engines for the more efficient use of steam for driving machinery.

On January 6th.—52 to 61.—M. Gandy. Treating and preparing paper, paper felt, and paper stuff to manufacture a new material to be used as a substitute for wood, leather, and other materials in "construction," and applicable to various useful purposes.—J. Bowman. Bottles, and the means employed for stopping or corking the same and other similar receptacles.—E. Milner. Furnaces for steam-boilers and other uses.—A. Dick. Compressed air or gas spring, and stuffing box to be used in connection therewith (com.)—H. Fisher and J. H. Rutherford. Mode of applying and utilizing heated air, and hot air engines or hydropneumatic motors.—T. Sington. Construction and working of railway signals.—C. J. Wollaston. Thermoelectric apparatus.—F. F. Burlock. Looms (com.)—A. Wilkinson. Manufacture of substances for road making and street paving, such substances being also applicable for fuel for locomotive stationary or portable engines, household and other grates.—E. T. Hughes. Claw hammers, parts of which are applicable to other hammers (com.)

On January 7th.—62 to 68.—R. Baker. Jacquards.—G. Bradley and T. Madderson. Construction of machinery for breaking and crushing stones, ores, and other substances.—J. C. Martin. Manufacture of emery and other wheels used for grinding or polishing, and apparatus employed therewith.—C. Simmons. Steam-boilers to prevent their priming.—J. Kidd. Manufacture of gas for lighting and heating purposes and the apparatus connected therewith (partly com.)—R. B Boyman. Rotary engines moved by the expansive power of fluids, the means of giving them such power, and the machinery and application of the same.—J. Wackett. Instrument or apparatus to be used in the slaughtering of animals.

On January 8th.—69 to 78.—T. Ellis. Preparation of dried yeast, and purifying and removing the bitter taste from the yeast of porter, ale, and beer.—R. Pye. Machinery for the manufacture of shuttle springs.—C. D. Abel. Motor engines worked by gas or combustible vapour and air (com.)—E. Bluck. Construction of railway carriages designed for the purpose of preventing accidents.—T. Whittaker, J. Duxbury, and J. Clayton. Machinery for moulding bricks, tiles, and other like articles. — R. Winder. Distributing type, and apparatus or appliances therefor. — E. Edwards. Safety lamps (com.) (Complete specification.)—M. Wilson, J. C. S. McLay, F. P. Warren, and W. Brodie. Manufacture of railway wheels and axles.—C. J. Weldon. Clasps or buckles.—D. Loewenstein and S. Wood. Doubling, twisting, and winding silk, cotton, and other threads, as well from the cop as from the bobbin, with a stop motion and without spindles, bands, or flyers.

On January 9th.—79 to 90.—E. Collingwood. Construction of bearings for upright shafts.—W. Clark. Railway breaks, and method of working the same, in part applicable to other railway breaks and to railway carriages.—T. Butler. Fabrics made on the Lever's lace machine.—C. Williamson. Stays and corsets.—L. Sterne. Railway couplings.—P. E. Ayton. Attaching door and other knobs to spindles.—J. H. Johnson. Apparatus for goffering, crimping, or fluting (com.)—J. M. B. Baker. Method and apparatus for drying steam boilers.—S. Fawcett. Looms for weaving.—J. Feldman. Fastening for buttons, and apparatus for fixing the same.—A. M. Clark. Apparatus for collecting rays of light and heat (com.)—W. Morgan-Brown. Means for closing and opening shutters and windows (com.)

On January 11th.—91 to 99.—G. Mackay. Purifying liquids, obtaining or preparing the purifying agents, recovering, treating, and utilizing matters contained in such liquids, as well as other waste or lye products of manufactures, and means or apparatus employed therefor.—R. Atkin. Construction, rig, and equipment of life-boats, rafts, and other vessels, and means for lowering and launching the same.—J. F. Mackenzie. Construction of hot-air apparatus for warming buildings, &c.—E. Rowland. Apparatus for compressing air, and for raising and forcing liquids by the air so compressed, or by steam pressure, partly applicable to measuring and indicating the quantity of liquid passing through the apparatus.—J. F. Zimmermann. Candle holders.—M. P. W. Boulton. Engines worked by hot gases or by hot gases and steam, partly applicable for generating steam.—J. Rowley. Means or apparatus for preventing splashing when walking.—M. Jenkinson. Fastenings for boots, shoes, leggings, and other articles.—A. M. Clark. Hydrostatic motor (com.)

Correspondence.

PATENT LAWS.

To the Editor of the SCIENTIFIC AND LITERARY REVIEW.

SIR,—In answer to your special notice to members of the Inventors' Institute, I send you my views about the new Patent Law Bill. 1st. The time for provisional protection must be extended from six to twelve months; and this ought to be granted on all applications for provisional protection, and not at the special will of the Lord Chancellor. 2nd. The fee for three years, after the first twelve months, to be just one-half the present cost, and in due proportion until the fourteen years' term ends. 3rd. All inventions for articles which are under the value of 10s., to pay a fee of £5 per year, as a difference in cost ought to be made between any patent for a steam engine, &c., and a small article. 4th. Licences ought to be compulsory, viz., to protect the manufacturing interests. 5th. A large Patent Museum to be built for models and plans, &c., and the models and plans to be put in classes, each class to be separate from one another. 6th. With regard to the trial of Patent Law infringement cases, and to avoid the very great expenses in the above courts, there ought to be a special Patent Law Court. The court must be presided over by a judge, and the jury ought to be men used to try patent cases, and chosen from a class of persons according to the patent in dispute. The expenses of such a court to be paid from a special fund from the overplus patent fees. This court would be much less expensive than our present law courts, as it is next to impossible for any inventor with a small capital to contend successfully with a large capitalist, therefore making any Patent Law quite absurd under the old system of trial. 7th. Chambers of Commerce would also be of much use, viz., to settle many Patent infringements by arbitration. The time —six months—is short for inventors with little capital to run the risk of losing £25 before the invention is sufficiently bought by the public; secondly, to extend the time to twelve months, would give the patentee a better chance to raise capital and to improve his models, as a patentee must be sure before he pays a second fee of £20; thirdly, want of capital, no doubt, makes many inventors abandon their patents, the payment being much too large for the three years; fourthly, extension of time is another way how to cheapen the first payment, and give a patentee a better chance to see how his invention answers in public use.—Yours truly,

H. E. HUTCHINS.

Tetney, near Grimsby, March 11, 1875.

SCIENTIFIC REVIEW
AND
Scientific and Literary Review.
A RECORD OF PROGRESS IN
ARTS, INDUSTRY, AND MANUFACTURES,
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APRIL 1, 1875.

WOOLLEN MACHINERY AND PATENTED INVENTIONS.

In its transition from the fleece on the sheep's back to the coat on the gentleman's back, wool passes through an innumerable variety of processes, of which the three principal and essential ones constituting the worsted manufacture are—1st, combing; 2nd, spinning; 3rd, weaving.

Now, it is a well known law, that the further removed from the raw or natural state materials are, the easier becomes the application to their manufacture of machinery. For substances which have passed through several phases of treatment and preparation are invariably so much the more regular and homogeneous in their structure. And it is this regularity and homogeneity which is the first requisite to mechanical treatment.

Hence it follows that machinery pursues the inverse course of original manufactures. That is to say, the process to which machinery is last applied must be the very process which was the first to be performed by hand. So in the case of wool; it must have been combed before it was spun, spun before it was woven. And yet the loom came before Arkwright's spinning machinery, and the combing machine after both.

It is true that the inventions of Jacquard were subsequent to those of Arkwright, but it must be remembered that, although Jacquard's loom was *the* loom *par excellence*, yet the loom was, as a mechanical contrivance, in use long before his day.

This being premised, the law holds good. We are now in a position to account for the tardy development of the combing machine, on the simple ground that the fleece being the raw material, the process of combing has to deal with the irregularities of nature more closely than those of spinning and a portion of weaving.

Thus it has come about that the great battle of machinery *versus* hand-labour, of iron *versus* flesh and blood, has raged for about a hundred years in the domain of fibrous materials before the final triumph of machinery.

The victors were led during the three generations by the three great captains—Arkwright, Jacquard, and Donisthorpe—each of whom conquered a province. And now, as the latter is borne to his last resting-place, the old hand-spinner, the hand-loom weaver with weary click, and the oil-daubed hand-comber are amongst the phantoms that people the regions of memory.

The last of these three great inventors, GEORGE EDMUND DONISTHORPE, died on the 13th of January last, aged 64. Born at Market Bosworth in 1810, at the age of 15 he invented an improvement in a stocking frame at first sight—(as it was being exhibited by its inventor)—which was at once adopted, and found to be of great value.

Following up his genius for mechanical construction, he manifested his skill over the whole broad field of machinery, till his success culminated in the most extraordinary invention of the age—the combing machine. This was secured by some dozen or so of patents, but those of 1844 and 1851 were the most important. Like all other patents of value, these were attacked and harassed without mercy, and some of them, as in Arkwright's case, were pronounced infringements. Men of mere technical mechanical knowledge might even now be at a loss to detect a resemblance between the infringed and infringer, but, as inventors are too well aware, what is not visible to the naked eye frequently becomes very clear in a court of law. Rival patents also were taken out, the relative value of which, said the *Encyclopædia Britannica*, "experience alone can decide." This was written in 1852. Since then experience *has* decided. No other combing machine save Donisthorpe's is, it appears, now in existence, and of these there are at work in this country upwards of two thousand. Reckoning the royalty on one machine at about £150 a year (which is near the mark), this represents about £300,000 a year as the legitimate income of the proprietor under a perpetual or life patent right. As things are at present, the worsted trade may be receiving over a million sterling per annum from the combing machines alone, exclusive of indirect advantages, which are enormous, while the inventor, after fourteen years, receives nothing. Surely this is a gross injustice, and a flagrant national scandal!

However, this is not the place to quarrel with the evil, but rather to admire the good. Like the spinning machines of Arkwright, its great predecessor, the combing machine, latest and greatest, is ours.

Thousands of hard working men will some day see that it is to such works as these, more than to Factory Acts and Eight Hours' Bills, that emancipation from monotonous drudgery and dirt is due; and they will themselves, with these examples before them, set to work to substitute iron for flesh and blood in their weary processes, provided the Lord Chancellor's new Patent Bill does not have the effect of discouraging all inventive effort on the part of those who have not a few five-pounds' notes to play with.

The decease of this great inventor, who was one of the original members of the Inventors' Institute, and so continued till his death, has led us to give this prominent though brief notice of his career; for, at the present moment, when an imposing array of members of the higher branch of our legislation speak of inventors and inventions in a disparaging manner, it is quite right that the nation should be reminded that the business of the world and the progress of our industrial system is dependent on the ingenuity and perseverance of inventors and patentees, and that this class of her Majesty's subjects is quite as much entitled to consideration and encouragement as the successful lawyers and staunch political partisans who find places in our so-called House of *Peers*.

We understand that it has been suggested that Bradford should possess a memorial of Mr. Donisthorpe, and we hope this suggestion will be favourably received.

Reviews.

SIR D. SOLOMONS ON SIGNALLING.

"A New Method of Signalling on Railways." Invented and Patented by SIR D. SOLOMONS, Bart. A. K. Baldwin, Printer, Southborough.

ALTHOUGH this is a pamphlet professing to advocate a particular system of railway signalling, yet, as it deals in a comprehensive way with the subject, which, moreover, is one of the highest importance, we present a view of the work to our readers as worthy of attention.

After some elementary statements on the subject, Sir David adds:—The battery also possesses a considerable resistance. When a battery polarises quickly—*i.e.*, soon ceases to give electricity, unless it is allowed a rest, or shaken, as in the Leclanché—considerable external resistance is necessary when a current is required for any length of time, in order to prevent the electricity from travelling too rapidly. The reader need not be troubled here with the various causes of polarisation, and the remedies, beyond being informed of the fact; nor will this phenomenon trouble us in the new system. The Leclanché has many advantages over other forms of cells; it will work for a very long period without recharging, it produces a large amount of electricity, and has a small internal resistance.

He then describes the new method proposed for signalling on railways, premising that when describing a subject which is new, it is always advisable to employ some systematic method for making it clear: such a course being now adopted.

THE RAIL AND SIGNALS.

To state the whole system briefly would be to say, "*every engine shall be a signal in itself.*" To make it obvious how this can be effected, the line will first be described.

In addition to the present pair of rails, a third would be necessary, and this one insulated. It might be iron, with an oblong section, say of 1 inch by 2 inches; so small, since there would be no strain whatever upon it. When laid, it would stand up as a small girder 2 inches deep. This would be supported on "chairs," and must be slightly raised above the ground. The present "sleepers" would be the fixing points for these "chairs." The rail would have a small piece of ebonite at its sides and below, which might be fixed to it, but only in those places where the "chairs" form supports. Imagine such a rail placed in position; then, to "tighten up," wooden wedges would be driven in on one or both sides of the rail, where the "chairs" are, and one below, which could raise it up, if at any time it were to sink. The pieces of ebonite on the rail would be rounded lengthwise, also chamfered away from the rail, so as to secure all wet should run off. The rails might be "fishtailed" one with the other. In describing this system minutely, it is not to be understood that this is the only way of carrying it out; they are so numerous, that a large volume could be filled in describing them. The intention is only to demonstrate one method, so as to make the general manner of using this system clear.

This line is laid in blocks, every block overlapping the last one, which is accomplished thus:—Where one ends and the next begins, instead of simply cutting the rail at this point, so as to make it discontinuous, the rail of the block in front continues, having formed a crook first, side by side with the line of the last block, although not in contact with it. The drawing shows this clearly, and represents a few complete blocks. The overlapping portion would be considerably longer than the distance required to stop a train going at a very high speed. In future, the overlapping piece continuous with the crook will be spoken of as the "front signal line," and the portion of rail running next to this, as the "back signal line;" since it is supposed the trains run towards the right hand of the figure, it is evident these terms are strictly logical, because the "front signal line" is continuous with the front block, and the other with the block behind. It is also seen that this rail is always in a straight line, except the crooked portions run by the side parallel to the system.

Under each engine are two metal wheels borne on one axis, which is supported by springs pressing downwards. These wheels are insulated one from another, by one or other of the numerous methods now in practice, and the distance between them is the same as the distance between the "front signal line" and the "back signal line."

Facing the direction in which the train is going, on arriving at the termination of one block and commencement of the next, one wheel (the left hand one) will roll on the "front signal line," while the other (the right hand one) will roll on the "back signal line;" but at other places the left-hand wheel will be free. To avoid a shock when it suddenly runs on or off the "front signal line," this latter is wedged off to nothing at its commencement, and rounded at the crooked end.

The engine carries several pieces of apparatus, but to commence, I will only suppose there is a battery and an electric bell.

One wire from the battery and one from the electric bell are taken to "earth," by being simply attached to the engine, the current passing through this to the ordinary railway lines which are connected with the ground. The other wire of the battery is in connection with the right hand wheel, and is insulated from the engine. The second wire from the electric bell, also insulated from the machine, is connected with the left hand wheel. The wheels just referred to are the signal wheels spoken of above. Now, suppose a train to be in a "block," then the right hand wheel is upon the line, and to this is attached a battery wire. One wire from the battery goes to earth, but since the other is now, through the signal wheel, in connection with the insulated line, no current can pass, unless this rail is "put to earth." Imagine another train to enter this block; of course it must somehow be signalled to to stop, or a collision will ensue. How is this to be done? Nothing simpler! The electric bell on this engine commences ringing so long as there is a train in the block it is about to enter, and the driver must pull up his train until it ceases ringing.

The reason for this is—the bell signal wheel of the second engine is at the commencement of a block on the "front signal line," and being connected with "earth" by the wire which passes first to the bell, then to "earth," affords the means of putting the front block line to "earth," and therefore completes the circuit of the battery on the engine in front (whose battery-signal wheel is on the rail), and also causes the bell to ring on the train behind. Moreover, this train, which has been signalled to stop, has control over all the block it has just run over, because its battery signal wheel remains on the line of this block, so if another train were to enter behind this one, *its* bell would announce a train in front, and so on all down the line. It may also be seen why the overlaps should be of considerable length, so that control may always be maintained over the block just passed over, notwithstanding the distance the train has run in pulling up. Later on, a means of stopping the train automatically, when signals are adverse, will be described. All the above is made clear when the diagram is referred to. From what has been said, it is evident every front train has control over a train behind, which is all that is ever required.

The invention, however, does much more than this. An *indicator* such as has been before described, is also employed; one coil in it being placed in the circuit of the battery signal wheel, and the other in that of the bell signal one, so that when a current passes the needle deflects right or left, according to which circuit has a current passing through it. Upon consideration of what has been detailed, the deflection of the needle is to one side or the other, according as a train is in the block in front or entering the block behind. But suppose both these events occur at once, then the needle will attempt to be deflected both ways at the same time, which is impossible, and therefore will either remain stationary, or move *slightly* to one side or the other, if the currents in the coils are not quite equal. It is then very easy to detect the signal, for *ordinarily*, when the needle is at rest, it means "safe," but when at rest by reason of a train in the block in front, and one *waiting* to enter the block behind, the bell is ringing, so no confusion can arise. The needle of the indicator on turning to the right or left strikes against a bell, the right one having a different tone from the left. Of course a lever on the arbor carrying the needle, or other arrangement, might easily effect this end. The indicator might have a dial marked below "SIGNALS"—on the left hand "train behind," at the right side, "train in front," and at the point where the needle stands when at rest, "bell ringing, train behind *and* in front." The magnetic needle would be slightly weighted to keep it vertical, as in an ordinary "detector." In such instruments I have never noticed any unsteadiness in the needle whilst in a train, but if this were found to be the case, it might be overcome by two small spiral hair-springs attached to the needle arbor by their centre ends, their other ends to fixed points, so as to be opposed to each other when in action. Indeed, this indicator is really not wanted for ordinary signalling, except that it is well to have two strings to our bow, so that if from any cause the current were weak, or the electric bell did not act, then the indicator would be most necessary; but these suppositions are never likely to occur.

Accessories are also described; likewise an automatic system for stopping trains, and the special fitness of the new method for application to crossings, sidings, and facing-points is shown; also another mode of producing the electricity is described by using on locomotives, instead of batteries, electro-magnetic machines, and the same "donkey engine" before spoken of to work the registering apparatus could be employed to work this electric current producer also. The electro-magnetic instrument consists, in its simplest form, of an electro-magnet rapidly revolving before a permanent one, poles opposed to poles.

There are many forms of electro-magnetic machines in use, but they are chiefly modifications of the one described, or induction is produced in some other convenient manner.

The current produced by this method being alternately reversed, a self-acting "commutator" is employed to cause the current to flow always in one direction, as is the case with a battery.

In *this* system the ends of the wire of the electro-magnet would be treated just the same as the wires of the battery, had one been employed.

There are many other statements in this little work well worthy of the attention of railway engineers and others interested in working railways; but we must leave our readers to procure it and instruct themselves.

RENSHAW'S CONE AND ITS SECTIONS.

"The Cone and its Sections Treated Geometrically." By S. A. RENSHAW, of Nottingham. London: Hamilton, Adams, and Co., Paternoster-row. 1875.

THIS work, although not written by an author already known in connection with the higher branches of mathematical science, shows very considerable knowledge on the subject which is treated, both in definition and diagram, in a clear and defined manner that will commend it to students of the subject on which it treats. To convey a notion of the aim and scope of the work, we cannot do better than give the words of the author as stated in the preface of the work:—

> "Modern writers, to a considerable extent, commence their works by definitions of the curves described in plano, such definitions being adapted to or derived from properties of the curves themselves; a strong tendency has, however, been shown, and especially by one geometer of the last century, Hamilton, to revert to the Apollonian method. Accordingly in the present work the primary properties of the sections are derived from the cone, and it is believed that this is the case to a greater extent than in any previous treatise. The reasons that have principally led to this course of treatment are first, that the elementary properties alluded to are by the help of the most elementary properties of the cone demonstrated, as it were, together, and their connection and mutual dependence shown in the clearest manner; and secondly, it is presumed that by becoming acquainted with these principles as thus deduced, a deeper impression is obtained of their great and essential importance than could possibly be the case were that acquaintance made by deductions from any definition of the curves in plano, seeing that according to the definition adopted the process of deduction must necessarily vary."

The author then explains the general arrangement of his work, and concludes with the hope that the reader will find this work of service in his prosecution of this highly useful and interesting branch of mathematical science, and that he will be urged to pursue it with vigour from the reflection that these curves, the conic sections, present us with no inconsiderable part of the actual design or plan, according to the principles of which the Great Author of Nature has arranged some of the most stupendous of His glorious works, and that upon a knowledge of them the intelligent comprehension of these sublime monuments and proofs of Himself and His attributes to a great extent depends.

To those interested in the subject treated we recommend the careful perusal of this work.

TRANSIT OF VENUS.

"The Transit of Venus, its Meaning and Use." By T. H. Budd, F.R.A.S. London: Longmans, Green, and Co. 1875.

The author states that his little work has been written to explain in simple and untechnical language the Transit of Venus, which great event was witnessed in December last, another being predicted to take place a few years hence.

The author has attained the object in view, and to those interested in astronomical matters, whether they are, or are not, acquainted with the science, will find this little work of value in showing what is meant by the Transit of Venus.

SIR H. HOLLAND ON SCIENCE.

"Fragmentary Papers on Science and other Subjects." By the late Sir Henry Holland, Bart. Edited by his son, Rev. Francis J. Holland. London: Longmans, Green, and Co. 1875.

We have gone through this volume with great interest, and looking at the wide range of subjects treated in the various papers, have been struck with the store of knowledge possessed by the author, who was not considered to be a profound scientific man, though, singularly enough, his evidence was on most branches received as being of great weight.

In the preface of the work we have an unfinished statement by Sir Henry Holland, which the editor states contained the last words written by his father; and in this statement we find the scope and intention of the different essays treated in the book. We cannot do better than quote from this statement, in which we are informed that the subjects the papers or essays (chiefly written within the last ten or twelve years) treat of are partly—

> "The discoveries and speculations of modern physical science; partly, those great problems of human life in its various relations to the world around, which have been touched upon in all ages of philosophy, but have become better defined in our own day, in effect of those stricter laws of induction which have been imposed upon human thought however directed.
>
> In writing these papers I made it a chief object to define as far as possible for my own instruction, the knowledge actually attained on each subject; the direction and possible attainments of the future; and the limits which in their very nature are impassable by human reason or research. Looking recently over these papers after the lapse of some years, I find that many of them would need to be rewritten to meet the demands of fresh discovery or more exact knowledge; while the questions involved in others have been so largely handled in modern controversy, that my treatment of them would have little other novelty than perhaps a closer *concentration* of the argument upon the conclusion sought for. Such method indeed, explicitly followed, has especial value in questions of the kind here alluded to. Strong or crucial proofs are enfeebled by contact with weaker ones, and an argument may be prolonged until it loses all its pith and purport."

In these papers, as stated, a variety of subjects are treated, embracing a very wide field. Here we have subjects bearing on theology in its relation to mankind, and also as to its bearing on science, which latter has, during the last year or two, been most ably argued, *pro* and *con.*; and these papers therefore bear an especial interest, seeing they were written before the question came prominently forward. Also papers bearing on the electrical, astronomical, and chemical sciences; and then into the domain of pure literary and historical matters, for we find, amongst others, an essay on Shakespeare. There are also included in the list three essays that have already appeared in one of the quarterlies.

We have thus given but a very general summary of what will be found in this work, for it is hard to give extracts out of so rich a store, and we must therefore, perforce, leave this work with a recommendation to our readers to get the work and read it for themselves, and we doubt not but they will learn something from the essays, combined with pleasant reading.

FIRE-PROOF STORAGE OF GUNPOWDER.

"Report of Trial of Fire-proof Gunpowder Magazines." By Major V. D. Majendie, R.A., H.M.'s Inspector of Gunpowder Works. Reprinted from "Proceedings, Royal Artillery Institution," No. I., vol. IX.

This is a very valuable report on a subject of the highest importance, as the late Regent's Canal Explosion fully testified. That in respect to danger from gunpowder explosion many people in our large towns are like persons living over a volcano, the following extracts will show:—

It must be evident that the storage of gunpowder in and about dwelling-houses and shops in such a way that it is exposed to the risk of explosion by fire greatly increases the risk of the firemen and all engaged in extinguishing the conflagration. The knowledge that a quantity of gunpowder was so stored might easily paralyse the efforts of the firemen, and cases might arise in which the superintendents of the brigade might be justified in refusing to expose his men to the desperate risk of entering a burning building containing a quantity of gunpowder. Some of the superintendents of fire brigades have furnished me with particulars of cases which have occurred within their knowledge in which either explosions from this cause have actually occurred or have been narrowly escaped.

The following abstracts from the Manchester Fire Brigade Reports, with which Mr. Tozer, the superintendent of that brigade, has favoured me, illustrate very effectively the nature and extent of the risks upon which I am insisting:—

Abstract from Manchester Brigade Report:—

"December 19th, 1864.—A fire occurred at A. Cadden's, gunmaker's workshop, No. 5, Brook-street. Before a jet could be attached, three heavy explosions of gunpowder took place, scattering bricks and the contents of the shop in all directions; part of the front wall and sides was blown out, and the rest of the building was in a very dangerous state. Having been informed that a large quantity of gunpowder was stored on the first floor, the superintendent was convinced that if it exploded it would do serious damage to the neighbourhood. The fire was soon after sufficiently subdued to send one of the firemen into the first floor to search for the gunpowder.

"Near the partition wall were five casks of loose gunpowder, which were brought into the street.

"One of the casks had been broken by the explosion, and part of the contents was spread upon the first floor. Upon examining the *debris*, several cases of gunpowder and cartridges were found.

"Before the arrival of the superintendent, there were several explosions of a large quantity of fireworks."

"November 4th, 1868.—A fire occurred at A. Shier's silk trimming warehouse, 13, Dyche-street, Rochdale-road.

"The basement floor was occupied by Mr. Lancashire, chemist, and contained a quantity of oil, saltpetre, resin, and eight extra-large casks of loose gunpowder, which was only damaged by water, although the flooring—which was 3 ins. thick—was burned through in four places. The fire was extinguished in about one hour."

"March 18th, 1871.—A fire occurred at J. J. Salis', printer's workshop, No. 1, Spring Gardens. On his arrival, the superintendent was informed that a quantity of gunpowder was stored between the roof and ceiling over the rooms on fire. The superintendent and chief engineer found about 1 cwt. in casks and cans, which were removed into the street, and afterwards to the detective office. The fire was extinguished in about one hour."

Many cases could be added to these. I myself was present at a fire at Inverness last September, when a cry was suddenly raised that there was powder in the building. Fortunately, it was found possible to get it out of the building and convey it to a place of safety.

Last October, an explosion of gunpowder from a fire occurred in Chichester—time having permitted only the removal of a portion of the store before the fire reached the magazine.

In October, 1871, an unexpected explosion of gunpowder occurred at Chelsea, while the fire brigade were in the act of extinguishing a fire which had broken out on the premises of Mr. Monk. The explosion occasioned the greatest alarm, and a good deal of serious damage, frightened the horses of the fire-engine, and caused them to run away, knocking down and injuring several persons.

These instances will serve to establish that the risk from the unsafe storage of gunpowder in places where it can be reached by fire is a real one. Indeed, it must be a subject of surprise to those who are acquainted with the practice of the retail trade in this matter that fatal explosions from this cause do not much more frequently occur.

Major Majendie considers that these circumstances will be best provided against by the use of a fire-proof magazine; hence he agreed to carefully test Messrs. Milner's fire-proof magazine.

The whole of these magazines had an internal capacity of 19 × 14 × 16 ins. = 4,256 cubic inches, and were intended to hold 100 lbs. of powder in canisters.

The principle of these magazines is that of filling the chambers with a vapourising material, such as alum, mixed with a certain proportion of non-vapourising, non-conducting material, such as sawdust. The original idea was, I believe, to fill the chambers with water, closing a number of holes in the interior with fusible plugs (of bismuth); when the plugs were fused by the heat, the water flowed into the interior, wetting the contents and rendering them impervious to heat for a considerable period.

This arrangement, ingenious as it was, was open to some practical objections. For example, the metal of the safes gradually deteriorated under the influence of the water, while the freezing of the water within the chambers was apt to injure the containing case. The present system, which I gather from the reports of a trial which took place in the Court of Queen's Bench (Milner *v.* Harrison), was originally invented and patented by a member of the present firm, is a more scientific application of the principle above mentioned. That is to say, the water, instead of being present in the shape of water, exists as water of crystallization in the alum—which is, in fact, composed of about half its weight of water. On heat being applied, the water escapes as steam, through a number of fine holes, into the interior of the safe, wetting the contents, and at the same time keeping the interior comparatively cool. The patentees claim in their specification "the exclusive use of any matter or thing evolving moisture on the application of heat." The principle of action—whether alum or any other similar material be employed—is the same. It consists in keeping down the temperature of the interior by vapourisation, and at the same time, by wetting the contents, rendering them less liable to injury by fire. Some experiments on a small scale had previously been made to test the applicability of this principle to the preservation of gunpowder from explosion by fire. It was believed that the steam preceding the inroads of the fire would so completely saturate the powder as to destroy its explosive properties; and the results of such experiments as had been carried out appeared to confirm these expectations.

However, no experiments of sufficient importance to warrant a confident recommendation of these safes as gunpowder magazines had been made, nor had the question been investigated as to how far the advantage of the vapourising principle would be neutralised if the powder were in hermetically closed canisters or cases—such as are generally used for sporting powder.

In order to elicit full information on these points, I determined to arrange the experiments as follows:—

Magazine No. 1 (designed to resist six hours) had placed inside it a small pinch of powder wrapped in paper, and six tin canisters, each containing about 2½ drms. (or about a rifle charge) of sporting powder. The canisters were closed in the usual way. To ensure the powder being distributed at different parts of the magazine, I caused the magazine to be filled with empty canisters, placing those which contained powder at different parts of the heap. The object of placing only small quantities of powder in this magazine was to enable it to be opened (for the satisfaction of the spectators) at the end of the six hours, without danger.

Magazine No. 2 (designed to resist six hours) contained 10 lbs. of powder, in ten 1 lb. canisters, supplied by Messrs. Curtis and Harvey, Hall and Son, Pigou and Wilks, and Lawrence and Son. The canisters, which were of the sorts usually sold, and of mixed shapes and various constructions, were put in unopened; and, as in magazine No. 1, were disposed at different parts of the interior.

Magazine No. 3 (designed to resist six hours) contained 25 lbs. of powder in an ordinary wooden powder-barrel, "quarter" size, and "headed-up." The powder was the sporting powder emptied from twenty-five 1 lb. canisters of various makers. The barrel was placed upon two bricks in the interior of the case, so as to occupy a position as nearly as possible in the centre of the magazine.

Magazine No. 4 (designed to resist eight or nine hours) contained 5 lbs. of powder loose in an open barrel, and 5 lbs. in five 1 lb. canisters (of Messrs. Curtis and Harvey, and Hall and Son).

In every case I personally superintended the placing of the powder in the magazines.

Furnaces were constructed so as to apply intense heat, and, in fact, intense heat equivalent to that of a blast furnace was applied. In the case of No. 1, at six hours and ten minutes, after the first fire had been lighted, the magazine was examined, and it was found that a hole had been burnt through the outer iron of the magazine, at the right hand lower corner—due, no doubt, to the heat, directed by the blast-holes, having impinged upon this part of the magazine. The heat had been sufficiently intense to fuze several of the bricks of the furnace.

The contents of the magazine were intact, except the powder in the paper, which had become damp and inexplosive. The powder in the canisters was dry, except in one instance, when some of the vapour appeared to have penetrated into the canister and slightly damped a portion of the powder. However, all the powder in the canisters was explosive, as I established experimentally by firing it. The steam had detached the paper labels from the canisters, and the vapourisation had evidently been entirely satisfactory.

The thermometers registered 210°.

It appears clear, therefore, that notwithstanding the intensity of the fire, the interior of the magazine had been preserved by the action of the vapourising material at about the heat of boiling water.

It was determined to leave the other furnaces to burn themselves out, and if not consumed or exploded by the following morning, to extinguish them. Sentries were placed on the ground, to warn persons off, and to note the time of an explosion, should one occur.

On reaching the ground the following morning (10th October), I found, says Major Majendie, that magazines Nos. 2 and 3 had exploded. No. 2 exploded at 2.22 a.m., having resisted the fire 15 hours 52 minutes. No 3 exploded at 5.45 a.m., having resisted 18¾ hours. No. 4 magazine was still resisting at 9.15, when, as I will presently explain, the experiment was arrested.

On examining the scenes of the two explosions, I found that they had been of a violent character. The explosions had taken effect in each case more or less in the form of a cross, the sides having furnished the lines or directions of least resistance.

In the case of No. 2, I found the door blown bodily 19 yards to the front—the fire had burned a hole completely through it; while to the right, fragments were blown 13 yards, to the left 17 yards, and to the back 20 yards. I picked up one of the canisters which this magazine had contained unexploded at about 20 yards—a circumstance upon which I shall have to comment presently.

The explosion of No. 3 (which had contained 25 lbs. of power) was naturally more violent than that of No. 2. The door was blown 64 yards to the front, and portions of the magazine were blown 32 yards to the right, another piece 30 yards to the back, another 40 yards to the left rear, another 52 yards to the left front.

A piece of alloy, the melting point of which was 482° Fahr., was recovered unmelted and unaffected by the heat.

No. 4 furnace was extinguished at 9.15 a.m., or 22 hours after being lighted.

On being opened, this magazine (No. 4) was found to be in very good condition; a few of the rivets had been drawn by the expansion of the metal, but it was otherwise uninjured.

The powder in the canisters was in one or two instances slightly damped. That in the barrel was encrusted, or superficially agglomerated to the depth of about 1-16th to 1-8th inch, and Professor Abel's analysis of this powder showed that this crust had sustained a slight loss of sulphur. Beneath the crust the powder was unaltered.

One of the thermometers (Negretti's) registered 250°, the other registered 220°. None of the alloys had melted, nor was the solder on the canistsrs affected.

The result of this experiment must be regarded as eminently satisfactory.

Of the three magazines designed to resist six hours—a more than sufficient time, in the opinion of the superintendents of the fire brigades, to warrant a magazine being considered practically "fire-proof"—one had resisted nearly 19 hours, another nearly 17 hours, and the third, when opened at the end of six hours, had been found to have its contents unexploded. The magazine designed to resist eight or nine hours, had resisted 22 hours, and then showed no signs whatever of any approaching failure.

Messrs. Milner have thus satisfactorily demonstrated that a magazine can be made which will be practically fire-proof—which will, indeed, resist for a longer period than it would be likely to be called upon to endure, a far more intense fire than in any ordinary conflagration could be directed against it.

It is worth while to consider in what way the explosions of the magazines Nos. 2 and 3 were effected, in order to observe how far the safes acted as had been anticipated. The expectation was that the vapour from the alum would penetrate to, and thoroughly saturate the gunpowder, and thus render it inexplosive. In the case of the powder which was hermetically closed in canisters, it was anticipated that when the temperature rose to about 240° the sulphur would begin to volatilise off, and so leave the remaining powder explodable only at a temperature far in excess of that at which powder containing sulphur explodes.

The first of these expectations was certainly not realised; the second was only partially so. It is quite clear, from the condition of the powder in the open barrel in No. 4 magazine, where the vapourising process was in active progress at the moment when the experiment was arrested, that no such complete saturation of a large mass of power is to be looked for. If a quantity of powder, exposed for 22 hours to the full vapourising action of the alum is saturated only to the depth of from about 1-16th to 1-8th inch, it is clear that the non-explosion of the powder is not to be referred to this cause, nor can be secured in this way. The powder in canisters, also, was similarly only partially affected by the vapour.

As to the volatilisation of the sulphur, there were—as detailed in Professor Abel's memo—indications that some partial action of this sort had commenced in the only magazine in which the temperature was registered as that at which sulphur will volatilise. If the thermometer is to be relied upon, the temperature in magazine No. 1 did not rise above 212°, which is about 28° below the temperature at which sulphur metals.

In the case of magazines 2 and 3, we have no means of forming an opinion whether the temperature did or did not rise to 240° (the explosions in those cases having been evidently due, as I shall show, to another cause), and the only powder recovered from these (the canister from No. 2) indicated no change in regard to its percentage of sulphur.

So No. 4 magazine is the only one which gives any reliable evidence on this point; and in No. 4 magazine the expectation that the sulphur would gradually disappear seems to have been partially realised.

There remains, then, to be considered:—Why did Nos. 2 and 3 magazines explode at all? Was the explosion due to a gradual and general elevation of temperature in the interior (in other words, to a gradual failure) of the magazine after the lapse of so many hours? To this question I think a confident reply may be given in the negative, for the following reasons:—

1. Gunpowder will not explode at a less temperature than about 560°. But there was recoved, as stated, from No. 3 magazine, a stick of alloy with a melting point of 482°, and this stick was quite unaltered. Had the temperature of the interior of the magazine risen to the exploding point of powder (560°) the alloy must have been melted.

2. There was recovered, as stated, from No. 2 magazine a canister of powder unexploded. Had the temperature of the magazine risen to the exploding point of powder, it is difficult to see how the powder in this canister could have escaped explosion.

3. Several pieces of canisters were picked up with the solder unmelted—and solder melts at a lower temperature than 560°.

4. We have the indirect evidence furnished by the observed temperatures in the two magazines which did not explode—viz., 212° and 250°, according to the thermometers.

On these grounds I think the hypothesis that the powder was exploded by the elevation of temperature in the magazine must be rejected.

In other words, I feel satisfied that the magazines fulfilled the requirement of keeping down the temperature by means of the vapour given forth by the alum.

To what, then, are those two explosions attributable? The answer is, I think, simple. They were due to the actual burning away of the iron at one point, the consequent penetration of the flame to the interior, and the explosion of the powder reached by the flame. There is direct evidence as to the burning away of the iron, because the door of No. 2 was found, as stated to be so burned through; and this was merely an enlargement of the effect which was noticed in No. 1 after six hours —a hole having been burned through the outer case of that magazine. In both instances it appears that this effect was due to the direct impingement of the flame, directed by the blast-holes, upon the iron; for in both cases the hole was burnt on that side of the magazine which was most exposed to the action of the wind.

In short, what happened was no doubt this:—The magazines amply fulfilled the object for which they had been constructed until the iron was actually burnt through, when explosions followed from the direct contact of the flame with the powder. It will perhaps be urged that the remedy for this is simple, viz., to make the iron thicker, or stronger. To this suggestion I would reply by anticipation.

1st. That no such increase of strength or thickness is necessary, since the resisting power is now considerably in excess of what is really required.

2nd. That such an increase of thickness would be disadvantageous, in so far as it would increase the cost of the magazines, and so (in the absence of statutory provisions compelling dealers to provide them) would tend to reduce the number of purchasers.

Moreover, if any purchaser desires an extra-resisting magazine, he can of course obtain one of the strength of No. 4. But for ordinary purposes, a magazine of the type of Nos. 1, 2, and 3 would be entirely satisfactory, and may be regarded as thoroughly fire-proof.

It is to be hoped that it will be found practicable to supply these magazines at a rate which will place them within the reach of retail dealers generally. Messrs. Milner inform me that they have no doubt of being able to supply them (to hold 100 lbs.) for 10 guineas; and considering the great increase of public safety which would result from their general employment by retail dealers, it is a question whether their use for all cases in which sufficient isolation from dwelling-houses, stores, &c., and from the resulting fire cannot be secured, might not fairly be made compulsory.

But in the absence of any provision to this effect, it is desirable that every encouragement should be given to dealers to adopt this mode of keeping their powder; and where (as in Ireland) the keeping of powder forms the subject of a licence, I think the magistrates would exercise a wise discretion in calling upon the licensees to provide fire-proof magazines of this or some other proved construction.

It is of course very desirable not to limit approval to the magazines of a particular maker; and in order to stimulate competition and improvement in the production of these magazines, I think that every safe-maker who desires to submit one should be afforded the same facilities for carrying out an experiment, at his own expense, as were accorded to Messrs. Milner. And in the event of any other maker producing an equally resisting magazine, that also should receive an official certificate of proof similar to that which I propose to give to Messrs. Milner.

The plan which I propose to adopt with regard to the certificate, and in order to secure to purchasers that the magazine they are purchasing is of equally resisting power with those which I tested, is as follows:—

I propose handing to Messrs. Milner a written certificate that magazines made by them, and of a particular construction, as shown in the signed specification and drawing to be attached to the certificates, have resisted certain tests.

Messrs. Milner will then number each safe, and give to the purchaser a guarantee in duplicate that it is of the construction referred to in my certificate. One of these guarantees will be affixed to the magazine, the other will be handed to the purchaser.

I should propose to follow a similar course in the event of the magazines of any other makers establishing their title to such a certificate.

As to all which we can only say that the Major appears to have adopted a very proper course in this matter, and come to a right conclusion.

GEOMETRY AND MENSURATION.

"Geometry and Mensuration for Schools." By W. J. Browne, M.A., Lond. Part I.—First Book of Euclid and Mensuration of Rectilineal Figures. Belfast: William Mullan. 1875.

Of making books there is no end, and undoubtedly this is true of so-called text books for schools; however, our author does not think so. Certainly there is nothing different in book 1 (Euclid) to what is ordinarily found in all works of this kind; the only part, therefore, in which novelty may be present is that relating to mensuration, and this we are pleased to find is put very clearly, with a considerable number of exercises interspersed. Still, on the whole, looking at the number of excellent little text books at present in use, we are inclined to think that the addition to them of this work was not necessary. We find no fault with the work itself, which well fulfils the objects the author has in view.

BANTING ROGERS AND PARLIAMENT.

"Correspondence between John Banting Rogers and the Right Hon. B. Disraeli, relative to False Parliamentary Returns supplied to the House of Commons by Officials of the Marine Department of the Board of Trade, and other matters connected therewith." London. 1875.

If any one wishes to get an insight into the "perils that environ" an inventor whenever and wherever he may be, so long as he still persists, as Mr. Rogers does, in pressing his invention upon the public notice, he will get this pamphlet, and give it careful perusal. Knowing Mr. Rogers well, we can inform our readers that they may listen to his statements as being worthy of serious attention. His address is 4, Three Colt-street, Limehouse, E.

SEA FISHERY.

"Deep Sea Fishing and Fishing-Boats." By E. W. H. Holdsworth. Stanford.

Mr. Holdsworth's work is as instructive as it is interesting, being the contents of a Blue Book fined down to suit the mental palate of general readers, with such additional information as Mr. Holdsworth, from his connection with the Royal Sea Fisheries Commission, has been enabled to supply.

VALLEYS.

"Valleys, and their Relation to Fissures, Fractures, and Faults." By G. H. Kinahan, M.R.I.A. Trübner and Co.

This work seeks to direct attention to other causes than meteoric abrasion as accounting for variations of the earth's surface, and however much difference of opinion there may be about the author's views, all will agree that he has produced an instructive book.

ST. JAMES'S MAGAZINE.

The April number of this popular periodical commences the first volume, an entirely new series, and contains an admirable article by the Rev. Dr. Hayman, the late Head Master of Rugby on the "Eastward Position" entitled, "Altar *versus* Table," as well as articles by Mr. J. J. Powell, Q.C., on "The Bar;" by Mr. Moy Thomas, Walter Thornbury, Mortimer Collins, J. C. Paget, Miss Duff, and "Olla Podrida; or, Table Talk," by the editor, Mr. S. R. Townshend Mayer.

ARTIZANS' AND INVENTORS' PATENT BILL AMENDMENT COMMITTEE.

At a conference of skilled artizans and others, held at 14, Clement's Inn, Strand, W.C., Mr. Thos. Paterson in the chair, it was resolved to form a committee under the above title to agitate for the introduction of amendments in the Bill introduced by the Lord Chancellor, particularly for lessening the cost of patents, and for making the protection afforded by patents more effectual. The following names have already been placed on the committee:—Mr. Thomas Paterson (chairman), Messrs. Pickering, Kenny, Cornish, Broadhurst (treasurer), Gosling, J. Morgan, S. Brighty, A. J. Murray, Golding, M. M. Harris, Calley, R. Smith, Campin, Yates, and Varley.

Mr. C. G. Carttar and Mr. Thos. Mottershead will act as honorary secretaries, and communications may be sent to them at the above address. The meeting of the committee will be held at 14, Clement's Inn, on Monday, the 5th April, at eight o'clock p.m.

THE PATENT LAWS.

At the meeting of the Society for the Promotion of Scientific Industry, at Manchester, on March 4, Mr. Hugh Mason in the chair, Mr. W. Lloyd Wise read a paper on "Protection for Inventions and Amendment of the Patent Laws." He submitted it as a question worthy of the most anxious deliberation how existing defects in the Patent Law may be remedied, and their beneficial scope extended in furtherance of the desirable advantage of maintaining for England its old position as the industrial leader of the world. In doing this he took it for granted that a Patent Law is in itself desirable, believing, in spite of contrary authorities, who he acknowledged demanded the highest respect, that it would be in vain to look for a decided practical opinion in favour of abolishing patents from any source that can honestly be regarded as thoroughly competent and unprejudiced. After considering the schemes of abolitionists, he maintained the Patent Laws ought to be upheld, and, if possible improved. A good and liberal Patent Law was needed to establish a rightful and mutually advantageous connection between the skilled artizan and the capitalist, whereby the ingenuity of the one and the money of the other might be advantageously made to co-operate, not only for the good of the artizan and of the capitalist, but also, and in the very first degree, in the interests of the people, as an industrial nation. They could all call to mind the names of many who have ultimately become large manufacturers, whose rise and progress had been in no small degree due to the incentive afforded by our Patent Laws, imperfectly as those laws have heretofore been administered. He believed that the laws, even as they stand, were capable of being carried out so as to meet the objections of all but the most impractical illusionists. Assuming, then, that a Patent Law is desirable, he addressed himself to the question by what amendments—whether in the law itself or in its administration—may the promotion of its objects be facilitated? The first alleged objection he would deal with was that many frivolous and useless inventions are patented. If they once admitted the questions of frivolity and utility into consideration in the granting or withholding of patents, endless difficulty and frequent injustice, not to say public loss, must inevitably result, regard being had to the differences of opinion that exist as to what constitute frivolity and inutility in an invention. Many inventions so simple in character as to appear at first sight frivolous, if not useless, might be enumerated as having tended largely to the convenience of the public, as well as to the benefit of the inventors and of the manufacturers, without detriment to anyone. If the inventions were really so frivolous, it was difficult to conceive how injury could result from the placing of an obstacle—if a patent be an obstacle—in the way of their use. No one could be injured, one would suppose, simply by being prevented from using a useless thing. On the other hand, it cannot be denied that very serious public injury would result in many cases by refusing patents, and so counteracting the exertions of those who would promote the introduction of apparently frivolous but in many cases really valuable inventions. Such, there were grave reasons to fear, must be the effect of some of the provisions contained in the Patents for Inventions Bill, lately introduced by the Lord Chancellor in the House of Lords, and read for the second time on the 26th Feb., should that Bill become law in its present form. The next objections were that patents were granted for things that were old; and that in many cases the claims are ambiguous! These allegations were true, and constituted the most substantial grievances pertaining to the present mode of administering the patent laws. All were agreed that a properly organised system of examination as to novelty, preliminary to the granting of letters patent, would be most desirable. The points upon which all are not agreed referred simply to the mode of conducting the examination and the manner of subsequently dealing with the application for a patent, in reference to which the examination may have been made. Great stress had been laid upon the fact of specifications being drawn up in a loose and vague way, rendering it exceedingly difficult, if not impossible, to correctly determine the nature and extent of the invention claimed. This complaint had very strong foundation in fact; but the ambiguity complained of was by no means invariably attributable to intentional deceit on the part of the patentee. His belief was that it more frequently arose from the patentee not seeing the way clear to making specific claims, in consequence of his inability to afford the time for making a search himself, or the money employing someone to search for him. His advice to intending patentees invariably was to search before applying for letters patent, and he was fully satisfied that this plan would be followed out by inventors to a very far greater extent than it was, and that there would be a consequent large reduction in the number of invalid patents granted, if greater facilities for searching existed. In 1872 he had handed in to the select committee a number of recommendations for more thoroughly carrying out various provisions of the Patent Law Amendment Act of 1852.

After criticising various provisions of the Lord Chancellor's Bill, much to the same effect as Mr. Campin's observations, given in another column. He added, there remained some few points deserving consideration, such as the desirability of reducing the first costs of a patent; the advisability of deferring the £50 payment to the end of the fifth year, and reducing the final payment to one of £50 payable at the end of the ninth year. It was undoubtedly advisable also that additional time for making the various payments should be allowed in exceptional cases on payment or fines to provide against the loss of patents by accident or inadvertence. It had been suggested that there should be an assimilation of patent laws of all countries, and he thought there would probably be no insuperable difficulty in the bringing about of international arrangements based on some mutually advantageous basis. Mr. Wise concluded his paper, which occupied about two hours in reading, by reviewing the debate on the introduction of the Lord Chancellor's Bill in the light of the principles briefly summarised in the preceding report.

Professor Crestadoro said he had listened with great interest to the paper. What was wanted was security to an inventor on publishing his invention, and it was not equitable if in six months after obtaining provisional protection he was not in a position to carry it out, the law should take possession of it. He also urged that the experimentalist had an equal right to the invention as the inventor himself, because the invention could not be patented except by experiment, and that whatever time it took, whether six months or six years, to complete it, if the inventor could prove his authorship the law should not take possession of it.

Mr. Blair urged the desirability of a proper preliminary examination. A very important feature also was the power of revoking a bad patent, for the present system was really impracticable. The new Bill brought in by the Lord Chancellor contained many defects. The proposed number of examiners was altogether inadequate, and he would very much prefer a system of local registries throughout the manufacturing districts with competent men to conduct the examinations. He thought the proposal to curtail the duration of a patent would meet with great opposition. He should also like to see a system adopted by which patent trials might be tried in Manchester instead of going to London, and a trial by experts would be very much better than by a mixed jury, as at present.

Dr. Watts very much questioned whether scientific industry was best promoted by the patent laws as they existed at present, or under the new Bill proposed by the Lord Chancellor. He did not believe that when a great want was felt there was only one mind directed to the meeting of that want. They would find numbers of men devoted to it, and was it for the universal good that they should sacrifice everything to the man who happened to be first, perhaps by 24 hours? He was altogether opposed to the patent laws, and, as an alternative, he urged that an inventor should simply register his invention, then work it as much as he liked, wait as long as he liked, and then apply that its value might be assessed by a board of competent persons, who should award him what they considered a proper remuneration out of the consolidated funds. He believed that they would not arrive at any law that would be satisfactory that was based upon shutting out the public, and such laws would break down of their own weight.

Mr. Frank Spence suggested that, to prevent the tendency of the discussion from becoming desultory, it would be well to take the sense of the meeting in the first instance upon the question whether a patent law is in itself desirable.

Mr. Rolffs called attention to a proposal in the Lord Chancellor's Bill which had been overlooked by the reader of the paper and previous speakers, namely, that a patentee should be compelled to grant a licence to any applicant. Under the operation of this provision, he said a patentee might easily be ruined by his own invention. A powerful rival in the trade might buy a licence to use a new invention, and then make the new machine so badly as to discredit it in favour of his own less perfect but tried and established machine.

Mr. Evan Leigh said that though a great deal might be said about the imperfection of the present law, if the Bill of the Lord Chancellor became an Act it would be far worse in many respects. It was true that many frivolous patents were taken out, but these injured nobody but the inventor, who simply lost his money and made a fool of himself. ("Hear, hear," and laughter.) No manufacturer was obliged to use a patent, and he had found it very difficult indeed to induce them to take new machines up when it had been greatly to their interest to do so. He endorsed Mr. Rolff's objection to the proposal to grant a license under compulsion, and illustrated it by stating that he had granted licenses to several first-class makers to carry out one of his inventions, but they had done it so imperfectly that he was obliged to take it in hand himself before he could make it succeed. What they chiefly wanted in the amendment of the law was, in his opinion, a special judicial arrangement for the trial of patent causes, and the establishment of a jury of experts to sit in such cases. He would further rule that every case should be decided after three trials, on the principle of the best of three, in order to prevent a capitalist dragging a poor inventor through the courts and ruining him, or exhausting him into submission. He thought that the time for amending specifications after an invention had been registered should be extended from six to twelve months.

Mr. W. H. Wood argued that the inventors of useful machines should not be allowed a monopoly for years of a happy idea, in which perhaps they had only anticipated someone else equally ingenious and laborious by a few days, but that successful inventors should be rewarded by Government.

The debate was adjourned.

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THE INVENTORS' INSTITUTE,

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Past Presidents :

SIR DAVID BREWSTER, K.H., LL.D., F.R.S., &c., from the establishment of the INVENTORS' INSTITUTE, till his decease, February, 1868. LORD RICHARD GROSVENOR, M.P.

President of Council :

SIR ANTONIO BRADY.

MEMBERS MEETINGS AT 8 P.M.

On Thursday, April 8th, Discussion on Mr. HARDY'S paper on "Traversing Crank."

On Thursday, April 22nd, Mr. CALLEY on "New Appliances for Saving Life from Shipwreck."

The Lord Chancellor's Patent Law Bill to be considered on same evenings.

Council and Executive Meetings on the same Evenings at 7 p.m.

Subscriptions are payable to Mr. G. A. STRETTON, the Receiver, 4, St. Martin's-place, S.W., who is the proper official to give receipts.

F. W. CAMPIN, Sec.

Proceedings of the Institute.

On Feb. 25th the Executive met, and the secretary, Mr. Campin, read a draft paper of observations on the Lord Chancellor's Patent Law Bill, which we give in another column, he having just sent this to his lordship. These were approved of as to general tenor and effect, the executive holding itself free to differ on some of the points, and to add anything further if found desirable. The vice-presidents of the Institute, members of the House of Peers—the Duke of Manchester and Earl of Caithness, were directed to be applied to with the view to secure their opposition to the Bill for the objectionable particulars of it.

On 11th March the Executive met, when the secretary reported that he had received an acknowledgment of the receipt of the paper of objections sent to the Lord Chancellor, which he promised should have his best consideration. It was also reported that special action was being taken to arrange oppositions to the Lord Chancellor's Bill when in the House of Commons.

On 25th March the Council and Executive met, and after some routine business had been transacted, a conference on Patent Law was held, Sir ANTONIO BRADY, president. Resolutions were passed for forthwith carrying out the project proposed on 25th Feb. of a general meeting of all interested in the subject to consider the Lord Chancellor's new Patent Bill, a sub-committee for organzation thereof, also a sub-committee to analyse the Bill, reviewing Mr. Campin's observations, and to report to council in the matter, were appointed.

The following additions have been made to the list of members:—J. Hopkinson, T. Pearson, S. Woodall, R. V. Angus, H. Conradi, C. Clinker, C. H. Wilkinson, Capt. C. Warren, R.E., J. B. Thompson, W. H. Ryves, W. Cooper, T. E. Clarke, — Baxter, C. Bellamy, R. J. Browne, J. B. Breelem, K. M. Sandys, W. Soper, W. G. Fearnley, W. W. Good, Lloyd, Lupton, Lewtas, J. Macintyre, J. F. Meakin, Lieut.-Col. Martin, Newton, Pulsford, Runnell, E. Turner, F. Trash, B. Templar, C. Williamson, G. Whyte.

Monthly Notices.

Dr. J. E. Grey, of the Natural History Department in the British Museum, died on the 7th ult.

The Recent Formation of Metallic Crystals, such as those often found in copper lodes, has lately been brought under the notice of the French Academy by M. Daubrée. During the drainage of a well at the hot springs of Bourbonne-les-Bains (Haute Marne), the muddy bottom was laid bare, and found to contain a number of Roman coins, statuettes, and other objects in bronze, silver, and gold. But immediately below this level the workmen came upon a bed made up of fragments of rock, chiefly sandstone, cemented together by certain metallic sulphides, which, in many cases, were well crystalised. They included examples of copper pyrites, *Buntkupfererz* or "horse-flesh ore," copper glance or sulphide of copper, and, what was most notable, tetrahedral crystals of a double sulphide of copper and antimony, identical with certain varieties of *Fahlerz*. The minerals appear to have been formed by the reduction of metallic sulphates, through the agency of vegetable matter, and to have been precipitated among the fragments of stone which they have cemented into a breccia. The thermal waters issue from the New Red Sandstone at a temperature of about 60° C. It can be proved that the formation of these minerals cannot have extended beyond sixteen centuries.

Mr. John Timbs recently ended his mortal career. He was a well-known compiler of pleasant books. Our readers will have known him best as the editor of the "Year Book of Facts in Science and Art."

The death of Mr. Robert Hardwicke, publisher, of Piccadilly, is announced.

Messrs. Macmillan will publish shortly a volume by Mr. Thornton, on "Public Works in India," and other kindred subjects.

The German observers of Venus' transit have had success in Kerguelen's Island. This leads us to hope for a similar result obtained by the British Expedition, of which no intelligence has yet arrived.

Mr. Wilson, Professor of Mathematics at Melbourne University, who was in charge of one of the Transit observing stations, situated at Mornington, died suddenly on the 11th of December, two days after the Transit. Professor Wilson was senior wrangler in 1847, and was the author of a Treatise on Dynamics.

Royal Society's Conversazione is fixed for Wednesday, 7th April. This gathering will be of the usual character, but "receptions" are to be held in May and June, which will be simple in form and limited in number. Visitors will be at liberty to wear morning or evening dress, which may be regarded as an intimation that a friendly, sociable spirit is expected to prevail.

M. Palisa discovered another new planet (No. 143), at Pola, on the evening of February 23. This is the fifth planet that that astronomer has discovered, all within a year, the first being "Austria," on the 18th of last March.

At last, intelligence has been received, *via* Cape Town, of the English party for observing the Transit of Venus at the important southern station of Kerguelen's Island. The success, though not complete, was considerable, both ingress and egress being well observed by one or other of the divisions of the party, none of whom, however, appears to have observed both. Clouds also interfered very much with the photographic observations. This news completes the telegraphic reports from all the British expeditions; and the general result has been such as fully affirm the prudence with which the selection of their observing stations was made, as well as the skill with which the different arrangements were, as far as practicable, carried out.

Prof. R. Willis, of Cambridge, is reported to be dead. He had held the Jacksonian Professorship for nearly thirty years.

Printers' Ink of sixteenth and seventeenth centuries has been found by Dr. R. C. Tichborne to differ from modern printing-ink in being soluble in ammonia. Carbon appears to have formed, from the first, the basis of printing-ink; and, consequently, all printed matter resists the action of acids and bleaching agents. But some of the early specimens of printing are so easily affected by alkalies, that the characters float off the paper when placed in a weak solution of ammonia.

Proceedings of Societies.

ROYAL SOCIETY.

FEBRUARY 18TH.—Dr. Hooker, C.B., President, in the chair.—The Right Hon. Sir Stafford Northcote, Chancellor of the Exchequer, was elected a Fellow of the Society. The following papers were read: "On the Nature and Physiological Action of the Crotalus Poison as compared with that of *Naja Tripudians*, and other Indian Venomous Snakes, &c," by Dr. Brunton and Dr. Fayrer,—"On the Number of Figures in the Reciprocal of each Prime Number of between 30,000 and 40,000," by Mr. W. Shanks.

February 25th.—Dr. Hooker, President, in the chair.—Mr. R. Mallet presented his large earthquake map to the society, to be preserved in the library for reference.—The following paper was read:—"On the Integration of Algebraical Functions, with Illustrations in Mechanics," by Mr. W. H. L. Russell. The Bakerian Lecture, "On the Forms of Equipotential Curves and Surfaces and Lines of Electric Force," was delivered by Prof. W. G. Adams.

March 4th.—Dr. Hooker, President, in the chair.—The list of names of fifty-four candidates for the fellowship was read. The following papers were read: "On the Tides of the Arctic Sea. Part VI. Tides of Port Kennedy in Bellot Strait," by the Rev. S. Haughton; "On the Determination at Sea of the Specific Gravity of Sea-Water," by Mr. J. Y. Buchanan; and "Note on the Value of a Certain Definite Integral," by Mr. I. Todhunter.

ROYAL SOCIETY OF LITERATURE.

FEBRUARY 24TH.—C. Clark, Esq., in the chair.—Mr. G. W. Moon read a paper "On Popular Errors in English," in which he discussed the changes that had taken place in both the written and spoken language of England during the last two hundred and fifty years, at the same time pointing out the value of preserving it in its purity, and adding a copious collection of errors, many of them in places where their presence would scarcely have been suspected. Many such occur in the English translation of the Bible; as, for instance, "Solomon was wiser than all men," which ought to be "all other men," for he was not wiser than himself, and "all" would have included him. So in such phrases as "no other alternative," "each one," "both of them," all "of them," the words "other," "one," "of them," are, respectively, redundant. Again, "none" is constantly used to govern a plural verb; yet this is incorrect, for "none," as compound of "no one," is necessarily singular. Mr. Moon further showed that change for the sake of euphony had proved one of the most fruitful sources of error, and further illustrated his views by quoting many humorous blunders in English sentences, arising generally from the defective arrangement of which they were composed.

ROYAL INSTITUTION.

MARCH 1ST.—The Duke of Northumberland, D.C.L., President, in the chair.—Mrs. W. Braine, Mrs. T. Jones, Mrs. G. L. Leon, Mrs. G. H. Lewis, Mrs. J. Scaramanga, Sir John Scott, Dr. H. Weber, Messrs. R. H. Alexander, B. Balfour, J. H. Bowen, T. Browning, H. J. Chaney, F. Lehmann, E. W. T. Hamilton, H. Rogers, G. F. Smith, T. Tomlinson, J. Vavasseur, and J. Westlake were elected members.

ZOOLOGICAL SOCIETY.

FEBRUARY 16TH.—George Busk, Esq., F.R.S., V.P., in the chair.—The secretary read a report on the additions that had been made to the Society's Menagerie during the month of January, 1875, and called particular attention to the following animals:—1. A Silver-backed Jackal (*Canis chama*, Smith) presented to the Society's collection by Mr. H. N. B. Good, who had obtained it at the Diamond Fields, Griqua-land. 2. A Banded Cotinga (*Cotinga cincta*, Bodd.) from Bahia, purchased the 18th January, and believed to be the first example of any species of this magnificent group of birds that had reached Europe alive. 3. A young Australian Cassowary (*Casuaris australis*), from Northern Queensland, presented by the Marquis of Normanby, F.Z.S., being the first example of this Cassowary received in a living state. Mr. Sclater exhibited a drawing of a supposed new Rhinoceros from the Terai of Bhootan, which had been forwarded to him from Calcutta, by Mr. W. Jamrach, who had the animal there alive, and intended bringing it to England. Mr. Sclater exhibited and made remarks on a living specimen of the Peguan Tree Shrew (*Tupaia peguana*) which had been presented to the society by the Hon. Ashley Eden, Chief Commissioner at Rangoon, British Burmah. This was believed to be the first specimen of a living *Tupaia* of any species that had reached Europe. Mr. A. H. Garrod read a paper on a point in the mechanism of the bird's wing, which renders it so specially adapted for flight. Mr. Sclater read remarks on the Cassowaries now living in the Society's Gardens, amongst which were representatives of five different species. One of them from the south of New Guinea was believed to be new to science, and proposed to be called *C. picticollis*. Mr. Sclater also gave a notice of a new Cassowary obtained in the Aroo Islands by Signor Beccari, and transmitted to the Museo Civico of Genoa, which he proposed to call *Casuarius beccarii*. Professor Owen, C.B., communicated a note on the discovery of the remains of various species of *Dinornis* in the province of Otago, New Zealand. Mr. Edward R. Alston read a paper on *Anomalurus*, its structure and position, in which he came to the conclusion that this peculiar form of rodents should be either referred to the Sciurine group of rodents as a distinct sub-family, or placed next to it as a separate family—*Anomaluridæ*. Mr. H. E. Dresser read some notes on the nest and eggs of *Hypolais caligata*, and on the egg of *Charadrius asiaticus*, and made remarks on the latter species, and on *Charadrius veredus*. Mr. R. Bowdler-Sharpe communicated a paper on the birds of Labuan, in which was given an account of a collection made in that island by Mr. John Low. The next meeting of this society for scientific business will be held at the society's house, in Hanover-square, on Tuesday, the 2nd of March, 1875, at half-past eight o'clock. p.m., when the following communications will be made:—1. Mr. H. E. Dresser.—Notes on *Falco labradorus*, Aud., *Falco sacer*, Forster, and *Falco spadiceus*, Forst. (Received 5th February, 1875). 2. Mr. A. Boucard, C.M.Z.S.—Monographic List of the Coleotera of the genius *Plusiotis*. (Received February 16, 1875.) 3. Mr. A. H. Garrod.—On the tracheæ of some of the rarer species of Anatidæ and of other birds.

March 2nd.—O. Salvin, Esq., in the chair.—Letters and papers were read from Dr. W. Peters, pointing out that the Sternothæus figured by Dr. Gray in the Society's Proceedings for 1873, to which neither specific name nor locality had been assigned, was *S. Niger*, and that its habitat was the Cameroons, from which place Dr. Peters had received specimens; by Mr. H. E. Dresser on the *Falco Labradorus* of Audubon, *Falco sacer* of Forster, and *Falco spadiceus* of the same author; by Mr. A. Boucard, containing a monographic list of the Coleoptera of the genus Plusiotis of North America, and giving the description of several new species; from Mr. E. P. Ramsay, "On Some Rare Eggs of Australian Birds;" by Mr. G. B. Sowerby, jun., "On Ten New Species of Shells from Various Localities; from Dr. T. Thorell, of Upsula. "On a Collection of Spiders made by Dr. Vinson in New Caledonia, Madagascar, and Reunion," amongst which were a few new species; from Mr. E. L. Layard, giving the description of some supposed new species of birds from the Fiji Islands; and by Mr. A. H. Garrod, on the lower larynx in some of the rarer species of Anatidæ: to this was added an account of the tracheal arrangement in *Platalea ajaja*, which differs much from that of the common Spoonbill; and reference was made to the manner of development of the tracheal loop in those of the Cracidæ which have recently died in the society's gardens.

GEOGRAPHICAL SOCIETY.

FEBRUARY 22ND.—Major-General Sir H. C. Rawlinson, President, in the chair.—The paper read was "Discoveries in Eastern New Guinea," by Capt. J. Moresby.—The following gentlemen were elected Fellows: Capt. W. S. Brooke, Capt. A. C. Walker, Capt. C. P. Wilson, Lieut. W. Rawson, Lieut. W. H. Smith, Lieut. J. E. Symons, Messrs, W. H. Bedbrook, G. Chater, jun., B. Colls, J. H. De Ricci, F. De Salis, J. Grant, H. Irving, E. W. Overbury, D. I. U. Robertson, G. G. S. Toler, J. Whyte, and E. Wynne.

March 8th.—Major-General Rawlinson, President, in the chair.—The following gentlemen were elected Fellows: The Marquis of Winchester, Sir C. E. F. Stirling, Gen. F. Cotton, Major Bates, Capt. J. F. Wilkinson; Messrs. T. R. Andrews, J. Bain, N. Bannatyne, J. P. Bell, H. B. Cotterill, H. R. Farrer, J. W. Goodinge, W. E. P. Hooper, J. Hunter, A. W. Jones, A. Luckman, J. Smythe-Osbourne, jun., and W. H. Trinder. The paper read was, "Examination of the Southern Half of Lake Tanganyika," by Lieut. V. L. Cameron, R.N.

ASTRONOMICAL SOCIETY.

FEBRUARY 12TH.—Anniversary Meeting.—Prof. Adams, President, in the chair.—The Report of the Council was read. It stated that there were 554 Fellows of the Society, and 45 Associates. Short obituary notices were given of Prof. Hansen, Dr. Mädler, the Comte De Pontecoulant, and Prof. Quetelet. Then followed reports of the work of the year from the principal observatories, public and private, and a résumé of the observations of the Transit of Venus, and of the principal astronomical results of the past year, among which may be mentioned the spectroscopic and polariscopic observations of Coggia's Comet, fresh investigations as to the scintillation of stars, Cornu's re-determination of the velocity of light, Struve's observations of ξ Cancri and the companion of Procyon, Mr. Todhunter's history of the theories of attraction and figure of the earth, Stone's observations of the total eclipse of April 16 in South Africa, and also a report on the progress of meteoric astronomy during the past year.—After reading the report, the Astronomer-Royal suggested that the secretaries should add to the biography of Prof. Hansen a note of the fact that the British Government had awarded to him a grant of £1,000 in recognition of his services in the advancement of the lunar theory. A somewhat warm discussion took place on the steps which should be taken for the recovery of certain instruments which had been lent by the society to a committee of the British Association for the purpose of observing the eclipse of 1871. The instruments had not been returned to the society, and, according to a report of the Melbourne Observatory, they had been presented to that institution by Mr. Lockyer, on the part of the British Association Eclipse Committee. The Astronomer-Royal pointed out the inconveniences which arose from the action of such a body in astronomical expeditions: nobody was personally responsible for instruments lent; and he had refused, upon a recent occasion, to lend instruments for a similar expedition, unless a personal guarantee could be given for their return. The President delivered his address on the presentation of the gold medal of the society, which has this year been awarded by the council to Dr. D'Arrest, for his catalogue of nebulæ and other astronomical works. The following gentlemen were elected officers for the ensuing year:—President, Prof. Adams; Vice-Presidents, Prof. Cayley, Mr. De La Rue, Mr. Lassell, and Lord Lindsay; Treasurer, S. C. Whitbread; Secretaries, Mr. Dunkin and Mr. Ranyard; Foreign Secretary, Mr. Huggins; other Members of Council, Capt. W. De W. Abney, Sir G. B. Airy, Sir E. Beckett, Mr. W. H. M. Christie, Mr. J. W. L. Glaisher, Mr. Knott, Rev. R. Main, Capt. Noble, Rev. S. J. Perry, Rev. C. Pritchard, Capt. Tupman, and Mr. J. M. Wilson.

ANTHROPOLOGICAL INSTITUTE.

FEBRUARY 9TH.—Col. A. Lane Fox, President, in the chair.—Messrs. J. Collinson, T. J. Greenfield, R. R. Jones, and J. D. B. Gribble were elected members.—The President exhibited a series of stone implements from the Alderley mines of Cheshire, and Dr. J. Simms exhibited five Lapp skulls.—A paper, by the Rev. W. Webster, was read, "On the Basque and the Kelt: an examination of a paper by Mr. B. Dawkins, 'On the Northern Range of the Basques,' in the *Fortnightly Review* of September, 1874." The author commenced by pointing out the danger of extreme specialization. The "Basque problem" had been taken up by pure philologists and pure anthropologists, who had neglected historical and archæological researches, folk-lore, literature, and the drama, and even the physical characteristics of the present Basques. The chief aim of the paper was to show how inconclusive was the evidence of anthropology alone, and to examine Mr. Dawkins's argument. It held that, firstly, philology had demonstrated the Basque language to be agglutinative; secondly, that W. Von Humboldt's conclusion is correct as to the existance of Basque names in the classical geographies and itineraries of Spain; and, thirdly, that although the identity of Basque and Iberian cannot be considered as perfectly demonstrated, its probability is very high. The special point of dispute was the conclusion of Mr. Dawkins, that "the former presence of an Iberian race in Armorica is demonstrated by Dr. Broca's map of the stature and complexion of the peoples of France."—Mr. Dawkins having replied to Mr. Webster's strictures, Prince L. Lucien Bonaparte remarked that the paper offered scarcely any point in which he could not cordially concur, especially where the author referred to the high competency of W. Von Humboldt in respect to the Basque language and ethnology; in fact, it was impossible to dispute the superiority of that eminent philologist on that special question over every modern author not by birth a Basque. He (the Prince) maintained that it would be as presumptuous to affirm that language is always a test of race as it would be, at least, hazardous to declare that anthropologists should invariably dispense with such a test. If an uninportant minority of philologists pretend to dominate over the anthropologists, they are wrong; but the minority of anthropologists who maintain that language should not be considered in the determination of race are still more in error. Mr. Sayce, as a philologist, maintained that language could not be held as a test of race; it was a test only of social contact. Mr. Hyde Clarke vindicated the claims of philology as a branch of anthropology and of natural science. He thought the Basque area of W. Von Humboldt should be much limited. The Basque had affinities with Houssa, and was thus connected with dark populations. Mr. W. J. Van Eys remarked that Humboldt had not proved the Basques to be Iberian. Prof. Busk, Mr. J. Rhys, Prof. Hughes, Dr. Simms, and Dr. Beddoe, also took part in the discussion.

GEOLOGICAL SOCIETY.

FEBRUARY 10TH.—J. Evans, Esq., President, in the chair.—The Rev. J. J. Goadby, Dr. R. Fritzgärtner; Messrs. E. H. Griffiths, J. Harte, J. C. Ross, W. H. Wilson, H. J. J. Lavis, H. Huxham, J. M. Black, and H. Norton were elected Fellows.—The following communications were read: "On the Phosphorite Deposits of North Wales," by Mr. D. C. Davies,—"On the Bone-caves in the Neighbourhood of Castleton, Derbyshire," by Mr. R. Pennington,—and "On the Mammalia found at Windy Knoll," by Prof. W. B. Dawkins.

February 19th.—Annual General Meeting.—J. Evans, Esq., President, in the chair.—The secretary read the reports of the council, and of the Library and Museum Committee.—The president presented the Wollaston Gold Medal to Prof. de Koninck of Liége; and the balance of the proceeds of the Wollaston Donation Fund to Mr. L. C. Miall, of Leeds. The president handed the Murchison medal to Mr. D. Forbes, for transmission to Mr. W. J. Henwood. The president then presented to Prof. H. G. Seeley, F.G.S., the balance of the Murchison Geological Fund. The president then proceeded to read his anniversary addresses. The following gentlemen were duly elected the council and officers for the ensuing year:—President, J. Evans; Vice-President, Prof. P. M. Duncan, R. Etheridge, Sir C. Lyell, Bart., and Prof. A. C. Ramsay; Secretaries, D. Forbes and the Rev. T. Wiltshire; Foreign Secretary, W. W. Smyth; Treasurer, J. G. Jeffreys; Council, H. Bauerman, F. Drew, Prof. P. M. Duncan, Sir P. de M. G. Egerton, Bart., R. Etheridge, J. Evans, D. Forbes, R. A. C. Godwin-Austen, H. Hicks, Prof. T. M'Kenny Hughes, J. W. Hulke, J. G. Jeffreys, Sir C. Lyell, Bart., C. J. A. Meyer, J. C. Moore, Prof. A. C. Ramsay, S. Sharp, W. W. Smyth, H. C. Sorby, Esq., Prof. J. Tennant, W. Whitaker, Rev. T. Wiltshire, and H. Woodward.

February 24th.—J. Evans, Esq., President, in the chair.—Before proceeding to the business of the meeting, the president referred to the death of Sir Charles Lyell. Messrs. C. A. Bock, C. N. Dresser, A. G. Renshaw, and W. H. Herbert were elected fellows. The following communications were read:—"On the Murchisonite Beds of the Estuary of the Ex, and an attempt to Classify the Beds of the Trias thereby," by Mr. G. W. Ormerod, "On some newly exposed Sections of the 'Woolwich and Reading Beds,' near Reading, Berks," by Prof. T. R. Jones and Mr. C. C. King, and "On the Origin of Slickensides, with Remarks on Specimens from the Cambrian, Silurian, Carboniferous, and Triassic Formations," by Mr. D. Mackintosh.

ENTOMOLOGICAL SOCIETY.

FEBRUARY 1ST.—Sir S. S. Saunders, President, in the chair. Mr. C. Livingstone was elected an Ordinary Member, and Mr. Aug. Sallé, a Foreign Member. Mr. Stevens exhibited a variety of *Noctua glareosa*, and Mr. Champion some specimens of *Amara continua*, a species recently detected in this country. Mr. H. Druce exhibited a fine collection of Rhopalacera, recently received from Santarem. The President exhibited a nest of *Polistes gallica*, taken on the Esplanade at Corfu, of which the cells were partly constructed with coloured paper taken from play-bills posted in the vicinity, as alluded to in his anniversary address delivered at last meeting. Mr. Smith remarked on *Colletes cunicularia* having been found a few years ago in the Isle of Wight and in Liverpool, and that, in 1873, he had transported some specimens from the latter locality to Shirley Common, and he had reason to believe that he had succeeded in establishing a colony there, as the insect had been taken near the spot in 1874 by Mr. D'Arcy Power. A paper was communicated by Mr. A. G. Butler, "On the Rhopalocera of Australia." A paper was read by Mr. W. A. Lewis, "On Entomological Nomenclature and the Rule of Priority." The president nominated Messrs. Dunning, Pascoe, and Weir as vice-presidents for the ensuing year.

February 15th.—Sir S. S. Saunders, President, in the chair.—Mr. F. H. Ward was elected an Ordinary Member. Mr. Phipson exhibited a singular variety of *Strenia clathrata* from Basingstoke, the wings being nearly unicolorous. Mr. F. Smith exhibited a second collection of Hymenoptera from Mr. Rothney, of Calcutta, containing 1,573 specimens, all in the finest condition. There were, probably, not more than twenty-five undescribed species, but from twenty to thirty species (which were hitherto represented in the British Museum by only one sex) were represented in the collection by the other sex. Mr. Verrall exhibited some living fleas taken two days previously from inside the ears of a rabbit, near Lewes. They were gregarious in this situation, and in such a position that the animal was unable to dislodge them by scratching. He alluded to a communication made to him by Mr. M'Lachlan, regarding a species from Ceylon, which had been gregariously collected in a very limited space on the neck of a fowl, and which had been exhibited at a recent meeting of the Microscopical Society. They were affixed to the skin of the fowl by the probosces, so that only the tails were outwards. Mr. Cole said he had found fleas in a hedgehog, and Mr. W. A. Lewis had observed a species on a Marmot in Switzerland. Mr. Dunning called attention to a recent extract from a French paper, in which it was stated that a paint could be manufactured from cockchafers. The Rev. R. P. Murray stated that Mr. Edwards, of Virginia, was desirous of obtaining pupæ of *Pieris napi*.

MICROSCOPICAL SOCIETY.

MARCH 3RD.—The new President, H. C. Sorby, Esq., having been formally introduced by Mr. C. Brooke, expressed his sense of the honour conferred upon him. A list of donations was read by the Secretary, and Mr. C. D. Barker was elected a fellow. Mr. H. J. Slack read some notes, translated from *Annales des Sciences Naturelles* and from Von Baer, which described an organization closely allied to that recently exhibited by Mr. Badcock, and assumed to be a species of Bucephalus, and some discussion as to its identity took place. A paper, by Dr. G. W. Royston-Pigott, "On the Principle of Testing Object-Glasses by Means of Images Produced by Reflection from Globules of Mercury, &c.," was read by the Secretary, and the diagrams in illustration of the subject were explained to the meeting by Dr. Pigott. A discussion followed, in which Messrs. Beck, Browning, Elphinstone, and the President took part. Mr. F. H. Wenham described, by means of black-board illustrations, a new method of viewing objects at extreme angles, and the value of this new mode of examination was explained. Mr. C. Stewart called attention to some new and beautiful specimens of Polyastinæ, exhibited in the room by Mr. Stephenson.

ARCHÆOLOGICAL INSTITUTE.

MARCH 5TH.—The Hon. W. O. Stanley, V.P., in the chair.—The Chairman adverted with expressions of deep regret to the decease of Prof. Willis, of Cambridge, one of the earliest and ablest supporters of the Institute, to whose admirable lectures upon the Cathedral so much of the popularity of the annual meetings had been due. The Rev. W. C. Lukis read a memoir "On Excavations in the Roman Station of Castle Dykes, near Ripon," a work which had been much stimulated by the meeting of the Institute in its vicinity last year, and by a grant which had been made from its funds. The station, which had been unnoticed by early writers on Roman remains, was for the purpose of keeping open communications between *Olicana* (Ilkley, and *Cataractonium* (Catterick). The memoir was illustrated by plans, &c., and by the exhibition of specimens of the objects found. The Chairman, Mr. Morgan, and Prof. Donaldson, made some observations on Mr. Lukis's memoir. Mr. O. Morgan exhibited twelve remarkable specimens of early watches, and an automaton clock from Augsburg, with curious striking movements, the special features of which he pointed out. Mr. Tregellas drew attention to an early lock-plate, exhibited by Mr. Bacon, from a door in the tower of South Lopham Church. On the plate were three buttons, which set free a bolt securing a staple which covered a key-hole. The door had been very massive, the room to which it led being a sort of treasury. Mr. Fortnum brought a sixteenth-century fork and spoon, silver gilt, with decorated stems, formerly in the Soulages Collection; and a case with knife, fork, and spoon, of an ornate character, dated 1791. Mr. King sent an impression of a fourteenth-century seal, found near Cambridge, representing the head of St. John the Baptist in a charger, with the legend "CAPUT BAPTISTE." This, he thought, might be the private seal of a Knight Hospitaller, it being found near a manor belonging to that fraternity. Some notes were read showing that the seal was more probably an evidence of the *cultus* of the Precursor in the eastern counties, of which other examples were known. Sir J. Jervoise sent some knives, forks, and spoons, together with a ring and an inscribed unset intaglio on onyx. Mr. Drummond exhibited a silver-gilt box, with German motto and engraved emblems, and an inscription, "Frantz Fixsen, 1748."

METEOROLOGICAL SOCIETY.

February 17th.—Dr. R. J. Mann, President, in the chair.—Mr. W. Arnold, Mr. H. Davis, Dr. J. M. Sutter, Dr. G. S. Thomson, Dr. J. B. Watson, and Prof. F. Van Rysselberghe were elected Fellows. The following communications were read: "Report of the Conference on the Registration of Phenological Phenomena." The council, during last session, resolved that it was expedient that observations of natural phenomena connected with the return of the seasons, as well as such other branches of physical inquiry as tend to establish a connection between meteorological agencies and the development of vegetable life, should be organised on a more systematic and scientific basis than heretofore. Application was therefore made to other societies interested in the matter to nominate delegates to form a committee for the purpose of drafting complete instructions, and organizing in an efficient manner this branch of investigation. Delegates were appointed by the Royal Agricultural, Royal Horticultural, Royal Botanic, Royal Dublin, Marlborough College, Natural History, and the Meteorological Societies. Meetings of this joint committee have been held, when the subject was fully discussed, and reports, prepared by the Rev. T. A. Preston and Prof. T. Dyer on plants, Mr. M'Lachlan on insects, and Prof. A. Newton on birds, adopted.—"On the Weather of Thirteen Summers," by Mr. R. Strachan. This paper is in continuation of others read before the society on the different seasons of the year.—"On a Universal System of Meteorography," by Prof. F. Van Rysselberghe. This paper gives a description of a recording apparatus, by means of which the indications of a great number of meteorological instruments of any kind can be registered, whether they are placed near to or far from it, so that simultaneous readings of several instruments at different stations can be recorded at a central observatory. The chief feature in this recorder is that it engraves automatically on metal the different curves, thus furnishing a plate, graduated by the instrument itself, from which as many copies as may be desired can be struck off. Another feature is that a single burin, put in motion by a simple electro-magnet, can engrave successively, on the same metallic plate, the elements of all the curves.

INVENTORS' INSTITUTE AND THE LORD CHANCELLOR'S BILL.

Observations on this Bill, prepared by the Secretary of the Inventors' Institute prior to the Bill passing Committee in the House of Lords, were transmitted to the Lord Chancellor, who, in acknowledging receipt of same, stated they should have "his most careful consideration," and the Bill, as amended in Committee, does show an attempt, though a wholly insufficient one, to meet some of the points referred to in these observations, which were in substance as follows:—

The intention of the Bill is commended as worthy of applause, as framed with the view to deal out evenhanded justice to inventors and to the interests of the public, real or supposed, so far as they are considered to be antagonistic.

But if some of its clauses be passed unmodified into law a fatal blow will be struck at the progress of invention in this country, inasmuch as the operation of these clauses will strongly tend, in a very considerable degree, to discourage inventors from bringing into public notice and industrially developing their inventions, especially in those numerous cases where inventors (artizans and others) have to act with money supplied by others in the very outset.

On clauses 6, 7, and 10, it was pointed out that *two* to *four* examiners would not suffice for the work, and that the referees would probably be biassed perhaps venal. In committee *six* has been given as the number of examiners and assistant examiners, and the referees are not to be required in every case.

Clause 8.—REQUIRING FULL SPECIFICATION *to be filed on application* for patent, unless great facility be given for amendment, and also for additions, will be a serious objection, for it is well known that inventions do not come into the world as Minerva sprung from the head of Jupiter—fully equipped at all points—but are first conceived as to principles and characteristics, and then elaborated as to working details by practical experiment, for which our law has hitherto made some provision by allowing time between the filing of the provisional and final specifications.

Clause 11.—The EXAMINATION (see subclauses *d*, *e*, and *f*) proposed by the Bill is highly objectionable. The power to any man or set of men to decide the worth or the frivolity of an invention, such as is given by this clause, *before* the invention has been practically tested in the workshop, or by actual industrial use, is one that those who know anything about inventions must at once acknowledge as most arbitrary—moreover, a power that cannot be used without the recurrence of frequent mistakes and much injustice.

No examination, *in limine*, can fairly be hoped to be equal to the decision of anything beyond "novelty," often very difficult to decide, as is evidenced by the trouble and difficulty attending patent lawsuits, which, be it noted, take place *after* the invention has been brought into practical use, and can, therefore, be judged of by practical results.

Perhaps the opinion of examiners might, with advantage both to the inventor and the public, be declared and recorded; but it ought to have *no effect as a rejection* of the application, except as regards proved *want of novelty*.

The RESTRICTION of AMENDMENTS in specification are—by the terms of clause 21—so stringent, that no practical advantage could possibly be obtained under said clause.

Moreover, almost all other Patent Laws than those of this country allow not only amendments, but additions of subsidiary practical details to be made, and it would be of immense benefit if this were allowed, at all events during the progress of the patent. Indeed, this would be the only way to render the requirement of a full specification in the first instance tolerable.

When amendment is refused to be allowed there ought to be an appeal permitted; this is not expressly provided for. The fee or stamp for amendment ought not to exceed £2.

The NON-REDUCTION of COST of PATENT, as per schedule of stamp duties, is, as regards a large number of inventors (artizans in particular), a great defect in this Bill.

The first step to protection of an Inventor should at all events be very CHEAP, and it is suggested that this might be provided for by allowing (as in America) a *caveat*, accompanied by descriptive declaration of invention, to be *entered*, which should, for *one pound* for three months, at least, prevent (*without previous notice to caveatee*) any patent passing for a given subject (say pumps for instance), with liberty of entering opposition, and entitling caveatee, upon proper proof of invention being filched from him, to stop an application in contravention of his caveat; or, where the matter remained in doubt, to prevent the grant of any patent except jointly to caveatee and the opposed applicant for patent. Upon filing an application for a patent during caveat, the caveatee ought to be entitled to have his application treated and adjudicated upon as if made on the *same day* as a *subsequent interfering application*. Entering a caveat ought to be *no publication* of invention, and no publication should ever be made thereof.

Several other clauses of the Bill require amendment of perhaps somewhat detail character (12, 13, 16, 19, and 27), and the enactment as regards compulsory licenses is so framed as to work great mischief.

AMENDED LORD CHANCELLOR'S BILL.

The Amendments in the Bill are not many or extensive, though of some importance.

Examiners (6).—*Two* Examiners and *two* or *four Assistant* Examiners are to be appointed.

Referees (12).—It is not to be compulsory to associate a Referee with the Examiner. The practice as to this is to be prescribed by Commissioners' rules (48).

Examination (Section 11).—Sub-section *f* now stands:—"Whether by reason of the frivolous character of the invention it is not worthy of a patent," *i.e.*, there shall be rejection of the application in the original Bill. "Frivolous character or *any other reason*" were grounds of rejection.

Amendment.—Here the Bill is altered, but not amended, it being left to the *caprice* of the Commissioners to say how applications for amendments pending application for a patent shall be dealt with, thus: "Where the request is made, pending the application, it shall be proceeded in and dealt with *as prescribed*," that is, by rules made by the Commissioners.

Foreign Inventions.—The following is new:—

"The publication in the United Kingdom of the invention by the circulation or republication of the foreign patent, or of any specification or document referred to therein in connection therewith shall not affect the validity of the patent." How about the publication of any other description of the invention?

The clause in original Bill making letters patent colonially operative is expunged.

VESSEL PROPULSION.

By R. J. Browne, Esq.

The following paper was read at the Members' meeting of the Inventors' Institute, held on Thursday, March 11:—

It has long been a matter of wonder to me that the enormous power produced by the motion of vessels in a seaway should never have been turned to account. We have, from a very early period in the history of shipping, availed ourselves of the force of the wind for the propulsion of vessels; and, more recently, we have called steam to our aid for the same purpose, whilst we have, at the same time, altogether overlooked a power lying in full view—namely, the power produced by the motion of vessels, which every vessel generates spontaneously, and which, as I shall presently show, is a power fully as great as that of steam, without the cost, available for her propulsion at all times when a ship is in a seaway sufficient to cause her to rise and fall four or five feet.

It is somewhat difficult to account for this enormous power open to the view of all, having been allowed to remain dormant so long. The only reason which occurs to me is this, viz., that our engineers and other men of science had not pressingly before them the requisite data to solve the problem of its application; or, perhaps, the whole matter was disregarded from the inventive mind of science being in pursuit of other objects. Indeed, there seems to be almost a fatality in these things, as the power of steam, though known ever since the time of Hero, has only been utilized at a comparatively recent period; and still later have gas and electricity been subjected to the uses of mankind, though both have existed within ken from the earliest times. It is, therefore, not so strange, perhaps, after all, that the tremendous power vessels generate by their own motion when at sea should have been thus overlooked.

Now, as to the rise and fall of vessels in a seaway, it appears from experiments made at the trial trip of the Channel squadron in 1873 (under the command of Rear Admiral Hornby, C.B.), consisting of the following vessels, viz., the "Agincourt" (which was the flag ship), the "Northumberland," the "Hercules," the "Sultan," and the "Devastation," that the rise and fall of each ship to the motion of the sea (taking the rise and fall as one motion) varied from 9 to 12 times a minute. And from experiments made by Mr. W. T. Deverell during a voyage from Australia, it was found, by means of a machine used for the purpose, that in a period of 2,026 hours the vessel made 1,764,080 beam rolls and 1,041,137 fore and aft oscillations, and that the average number of oscillations in both directions per minute was 14. The results of this last experiment were given in full at a meeting of the Institution of Naval Architects on the 27th March last, and are shortly stated in "Whitaker's Almanack" for the present year, page 232; and from both of these experiments may be deduced the following important facts:—1st. That vessels in a seaway rise and fall from 9 to 14 times a minute; and, secondly, it appears from the number of beam rolls and fore and aft oscillations during this voyage from Australia that this motion was almost constant, as the number of hours given amount to rather over 84 days of 24 hours each, being, it is presumed, the whole duration of the voyage.

It seems from what is stated in "Whitaker's Almanack" that these experiments were made by Mr. Deverell with the view of turning to account the force arising from the motion of ships at sea, and thus it appears that this gentleman has been contemplating the same source of power I have had in my thoughts very many years; but the application for my patent, with the provisional specification, was filed, and the patent itself is dated before Mr. Deverell communicated the result of his experiments to the Institution of Naval Architects, that communication having been made on the 27th March last, whereas my patent is dated the 5th March last, and I was not at all aware of Mr. Deverell's experiments until I saw a letter from him in the *Times* of the 2nd of last November. In fact, neither the experiments of the Channel squadron, nor these experiments of Mr. Deverell, in any way suggested to me the invention I have patented, as I have had it in my mind in general conception for very many years—twenty years and upwards—though I never worked it out in perfect detail until about a year before I applied for a patent; and whilst upon this point I may remark that these experiments, though affording valuable data, only tell us how many times in a minute vessels rise and fall in a seaway, but do not in any way solve the problem of utilising this motion of vessels for their own propulsion, which is what I claim to have accomplished.

With a few more words as to the commercial aspect of the question, I shall proceed to explain the invention. In a paper on the "Mercantile Marine of Great Britain," read by Captain Bedford Pim, R.N., M.P., at the Society of Arts, on the 27th of February, and published in that journal, it is computed that at the end of last year (1874) England possessed 22,000 sailing ships, of an aggregate tonnage of 5,300,000 tons, 2,500 steamships, of an aggregate tonnage of 1,200,000 tons, and as it is calculated that sailing vessels, by using this invention with an auxiliary engine will make their voyages in one-third less time, and that steamers will be enabled to dispense with the greater portion of their coals, and to carry so much more cargo, it is clear, if anything approaching this result be achieved, that the saving to shipowners in the cost of navigation will be very great indeed, probably not less than one-fourth of the whole amount, *i e.*, 25 per cent.

The object of the invention I am about to explain is to utilize the motion of vessels in a seaway for the compression of air, which may be used instead of steam for their propulsion.

As the ocean is rarely at rest, this invention will be available pretty well at all times when ships are at sea, and by the use of it the expense of coal (except, perhaps, a small quantity as a reserve, *i.e.*, in the case of steam vessels fitted with the invention) will be saved, and the space occupied by coal may be devoted to cargo.

The small reserve of coal may be taken for use in still waters (*i.e.*, in the case of steam vessels fitted with the invention), but whenever there is a sea on sufficient to raise and depress the vessel four or five feet, the invention will be in full work, and by means of it sufficient compressed air may be obtained for the propulsion of the ship, and thus a sailing vessel furnished with this invention and an auxiliary engine, will have pretty well all the advantages of steam without the cost. She may use both sails and engine when the wind is fair, but when foul she may take in sail and still keep on her direct course under her engine, thus by means of this invention turning a foul wind into a fair one, as it were, and getting rid of the obnoxious process of beating to windward.

The invention is one of great simplicity, and may be readily fitted to any vessel, steam or sailing, at trifling cost; and in the case of steam vessels the compressed air may be used (instead of steam) to work the existing machinery.

The *modus operandi* of the invention is as follows:—Chambers are fitted on the outside of the vessel, which chambers are open at bottom but closed at top, except a pipe connected with an air reservoir placed on board the vessel; in this connected pipe there is a valve, which allows the passage of air from the chambers into the air-reservoir, but which prevents its return, and there is also in this connection-pipe a provision for preventing water passing with the air into the air-reservoir, but should water by any chance get into the air-reservoir, it can be drawn off.

This is the whole of the machinery of the invention, simple as possible, there being nothing complicated or expensive about it, or likely to get out of order; it is, too, automatic, as whenever the vessel is in a seaway sufficient to submerge the chambers, the invention will be in full work. It may, however, be thrown out of gear, as it were, at any time by simply turning stop cocks, by which means the compressed air instead of passing into the air-reservoir, will be turned off into the open air.

Though only the submersion of the chambers is required for the working of the invention, the greatest possible dip of the vessel in a seaway will not prevent its working, as it will be effective in the roughest sea; it is only when the motion of the vessel is insufficient as she rises and falls to the sea to submerge the chambers that the invention will be inoperative.

The compression of the air is effected by the chambers affixed to the outside of the vessel, being caused to rise out of and dip into the water by her rising and falling under the action of the sea; when the ship rises, the bottom of the chambers being raised above water, any water in them will run out, and the chambers will become filled with air, and when the ship falls the chambers, being pressed by the weight of the ship into the water, the air therein will be compressed and forced through the connection-pipe into the air-reservoir for use.

The principle upon which the invention acts is dependent upon the *vis inertiæ* of water, and is virtually the same as that which obtains in the use of oars, paddle-wheels or screws, for the propulsion of boats and vessels. In these cases the boat or vessel is propelled by the pressure of the oar, paddle-wheel, or screw against the water, and this pressure is effective owing simply to the *vis inertiæ* of the water; so in the case of this invention, as the weight and impulse of the ship in falling in a seaway, forces the chambers outside her into the water suddenly and with irresistible force, the *vis inertiæ* of the water prevents its getting out of the way and allowing the escape of air from the bottom of the chambers, and the air in the chambers is forced into the air-reservoir and compressed to any degree required (the degree of compression is regulated by a weighted valve in the air-reservoir). It will thus be seen that the principle upon which this invention, as well as oars, paddle-wheels, and screws act in their impact upon water, is one and the same, as, were it not for the *vis inertiæ* of the water, none of them would be effective.

In short, it is the weight and impetus of the ship in her fall which compresses the air, the water, owing to its *vis inertiæ*, acting *pro tanto* as a solid body, against which the air in the chambers is pressed by the weight of the ship with irresistible force, and thus compressed to any degree required. The compression of the air is effected in this way, and not by the natural pressure of water —When a chamber open at the bottom is pushed quickly into it,—as the natural pressure of water under these circumstances, is only one pound for every two feet of immersion, and by it air could not be compressed to any great degree. It is, on the contrary, the weight and impetus of a ship in her fall pressing the air in the chambers with irresistible force against the water, acting *pro tanto* as a solid body, which is the principle which governs my invention. I have rather laboured this point, as the distinction is one of paramount importance.

For economical working of the invention the air should be used at an effective pressure of 60lbs. to the square inch, and to attain this pressure the air must (according to Mariotte's law) be reduced to one-fifth of its natural volume. Assuming, then, that in the case of a large ship each chamber affixed to her be a square of six feet by six feet, and five feet deep, each such chamber will contain one hundred and eighty cubic feet of air in its natural state, which, when compressed to one-fifth of its volume, will yield thirty-six cubic feet of air, having a force or pressure of 60lbs. to the square inch.

As to the number of chambers required to compress sufficient air for the propulsion of a ship, it must, of course, depend upon her size. Taking, by way of illustration, the Union Company's ship "Celt," a ship of the following dimensions:—Length, 315 feet; breadth, 34 feet; depth of hold, 28 feet; builder's tonnage, 1,811 tons; gross registered ditto, 2,095 tons, having compound engines, with cylinders of 36 and 72 inches respectively, and 4 feet stroke, with a four-bladed screw, 16 feet diameter, and 20 pitch, and which on her trial at the measured mile in Stoke's Bay, attained a mean speed of 11.444 knots per hour, average revolutions of engines 60 per minute, vacuum 26 inches, pressure of steam 61 pounds, draught of water 18 feet 5 inches forward, and 18 feet 4 inches aft, wind with a force of 5. Taking this ship as an illustration, the quantity of steam required to work her engine on this trial trip was 54 cubic feet each stroke or revolution of the engine, which, multiplied by 60, the number of revolutions per minute, gives 3,240 cubic feet of steam per minute (having a pressure of 61lbs. to the square inch) as the quantity of steam required in the above trial.

Now 3,240 cubic feet of steam at 61lbs. pressure is equal to 3,294 cubic feet at 60lbs. pressure; this, therefore, is the quantity of compressed air per minute, having that pressure which would have been required as a substitute for the steam used in the trial trip of the "Celt."

As will be seen by the data given, the rise and fall of the largest ships (taking the rise and fall as one motion) in a seaway is from 9 to 12 per minute. To be on the safe side, take the lowest number, 9 times, for this calculation, therefore as each of the above chambers at each immersion would produce 36 cubic feet of compressed air, having a pressure of 60lbs. to the square inch, and the immersion of each chamber would be 9 times a minute each, such chamber would produce 324 cubic feet of compressed air (having such a pressure) per minute, consequently 10 1-6ths such chambers would produce the requisite quantity, viz., the 3,294 cubic feet of compressed air per minute, having a pressure of 60lbs. to the square inch, mentioned above.

A small portion of the compressed air is, however, lost or wasted in the chambers to prevent a vacuum therein, and in the connection pipe below the valve, each time the chambers are raised out of the water; the quantity thus lost in each chamber is, say, a stratum of half an inch in thickness spreading over the whole of the top of the chamber, this is equivalent to one and a half cubic feet of air, and the quantity lost in the connection-pipe below the valve, taking such pipe at two inches internal diameter, and the length of pipe below the valve at 100 feet, would be two and one-twelfth cubic feet, giving a total loss of three seven-twelfths, say four cubic feet of compressed air per chamber each time the chambers are raised out of the water; the loss, therefore is, say, one-ninth part of the compressed air produced.

To make up for this, and to allow an ample margin for contingencies, instead of 10 1-6th such chambers fix twenty or more such chambers to such a vessel as the "Celt," and a proportionate number to a larger or smaller vessel; indeed, both the size and number of chambers affixed to a vessel must, of course, be regulated by her dimensions and tonnage, and the quantity of compressed air required; but whatever the size of the chambers, their depth should not exceed four of five feet, that they may be effective with a rise and fall of the vessel amounting to four or five feet, and in smaller vessels this depth may be reduced.

As air rushes into a vacuum (*i.e.*, under the pressure of one atmosphere) at the rate of 1,332 feet per second, and under greater pressure at a much greater rate, a two-inch connection-pipe is amply large enough to allow of the passage in due time to the air-reservoir of all the compressed air produced by a chamber of the above dimensions, the connection-pipe should not be larger than this below the valve (except in the enlarged part packed with balls), on account of the waste of compressed air in this part of the pipe. The connection-pipes may be carried in under the deck between the deck-beams, so as not to be an obstruction in any way.

The air-reservoir need not be large, as the supply of compressed air will be constant. One the size of a small boiler would be large enough.

These chambers may be fixed outside a ship so that the bottom of the chambers are just above her line of flotation; or to gain the benefit of the invention in a more moderate seaway, the chambers may be fixed at a lower level, so that the bottoms of the chambers be one, two, or even two and a half feet below the line of flotation. In the latter case, the lifting of the ship to a sea, say, two and a half feet above her line of flotation will free chambers from water and fill them with air, whilst the fall of the ship into the sea two and a half feet below her line of flotation will force the air in the chambers through the connection-pipes into the air-reservoir; thus when a ship rises and falls (taking the rise and fall as one motion) four or five feet, the invention will be effective, and this she does in a moderate seaway.

Again the chambers (at all events in new vessels), instead of being fixed entirely outside the ship, may be built or fixed partly within the outer planking, or skin of the ship, in a watertight compartment prepared for the purpose. Indeed, they may be built or fixed wholly within it, except that about one-half of the bottoms of the chambers must extend outwards beyond such outer planking or skin so that the water may be forced into the chambers with the weight and impetus of the ship as she falls in a seaway. And to effect this, the shape of the chambers may be varied by the bottoms and connecting sides thereof being extended beyond the outer planking or skin of the ship, or in the latter case, if the bottoms of the chambers be not thus extended, a sufficient opening must be left in the outer planking or skin of the ship to admit with requisite freedom the air and water to the bottoms of the chambers.

In the drawing filed with the specification the chambers are shown fixed entirely outside the vessel. To this two objections may be urged. 1st. The probability of their being carried away in rough weather; 2ndly. That they would lessen the way of the ship. The answer to the first objection is this, namely, that as paddle-boxes, false-sterns, and overhanging projections at the bows, &c., which were formerly, at all events, the fashion in the build of ships stand, and stood the stress of weather, there is no reason why these chambers, even when fixed entirely outside a vessel, should succumb, and as to any diminution in the way of the ship caused by the chambers, it may easily be counteracted (when sail is carried) by carrying a little more sail, just enough to neutralize the retardation caused by the chambers, and this may be readily done, as these chambers, when fitted outside, will give the vessel extra stability; indeed, the obstruction to the way of the ship would not be great, as the whole of the chambers on one side of a ship of, say, 2,000 tons, would not exceed in size a first-class steam launch. These are the answers to these objections, which may be urged when the chambers are fitted entirely outside a vessel. But when fitted inside, except one half of the bottoms of the chambers extended outwards, beyond the outer skin of the vessel, as before specified, the area of the part projected would be so small that its obstruction to the way of the ship will be infinitesimal, and this projected part will be altogether so strong and strongly fixed to the vessel, from its being of one piece with the other portion of the chamber fixed inside the outer skin of the ship, that it will be quite impossible it can be carried away by any violence of the sea. The latter mode of fixing the chamber, therefore, it may be conceived, is the preferable one, as it obviously and entirely gets rid of the above objections, which may be urged against chambers fitted entirely outside a vessel, though I do not consider the objections, even in that case, are of any material weight for the reasons given above.

After this paper had been read, Mr. A. J. Murray, member of Council and Executive, who occupied the chair at this meeting, said that no one could doubt that the subject of the paper was a very important one, for if an auxiliary propelling power for vessels could be obtained from wave motion, it would be of great service to sailing ships. He would not, however, at present say more on the subject, as he thought he ought to hear the opinions of other gentlemen before giving his own.

Mr. M. M. Harris inquired whether the invention had been applied to any ship. This was answered in the negative; and he then said that as far as he could judge, the wave action would be so uncertain that very little benefit would result from attempting to utilise it. There were several minor points of difficulty in Mr. Browne's invention, but he need not dwell on these, as, if the main difficulty he had alluded to were got over, probably they could be removed; of course, the invention would be of no use in a dead calm.

Mr. Calley observed that independently of the difficulty mentioned by Mr. Harris, he feared that the apparatus would take up a large portion of the vessel, which would be very objectionable.

Mr. Conradi intimated that he considered the wave-action could not be depended on for effecting what Mr. Browne wanted.

Mr. Hopkinson made some observations to the same effect.

Mr. Mottershead suggested that the wave cylinders would tend to steady the vessel, and so counteract the creation of force.

Mr. Campin said that if he understood Mr. Browne's propositions correctly, he did not seek for, or expect to obtain, a propelling power better than steam; he simply sought to get out of the motion of the waves an air-compressing power, the compressed air to work a piston in a suitable cylinder like steam in a steam engine does; such apparatus to be used as an auxiliary to the sailing power, and to be available principally in adverse winds, superseding in a great measure the necessity of "tacking."

Mr. Browne assented to these views.

The Chairman pointed out that the line of flotation was always the same whatever might be the height of the waves, and he feared Mr. Browne had not taken this into account. There were some cases, however, in which this invention might possibly be of service, and he was quite sure that every one would agree that the thanks of the meeting were due to Mr. Browne, and would be accorded to him for bringing so important a matter under consideration.

The Secretary then moved a vote of thanks to Mr. Browne, which being seconded by Mr. Carttar, was carried unanimously, and with the usual vote of thanks to the chairman the meeting ended.

An apparatus for safely lowering into the water ships' boats was exhibited by Mr. Calley at this meeting. All present seemed to consider it well designed, and likely to effect the object in view.

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